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Draft Environmental Impact Statement for South Escambia and Santa Rosa Counties Florida Wastewater Management

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Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365

EPA 904/9-84-118
April 1984

EPA

Environmental Impact Statement

Draft

South Escambia and Santa Rosa Counties, Florida Wastewater Management

REPRODUCED BY
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SPRINGFIELD, VA. 22161

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
for
SOUTH ESCAMBIA AND SANTA ROSA COUNTIES, FLORIDA

Prepared by
U.S. Environmental Protection Agency
Region IV
Atlanta, Georgia 30365

This Draft EIS addresses proposed wastewater facilities for South Escambia and Santa Rosa Counties, Florida. Numerous wastewater management alternatives have been evaluated with particular attention to water quality in the area's surface and groundwater resources and the impacts of projected population growth on the sensitive natural and human resources of the area.

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EXECUTIVE SUMMARY FOR THE
ENVIRONMENTAL IMPACT STATEMENT

SOUTH ESCAMBIA AND SANTA ROSA COUNTIES, FLORIDA
WASTEWATER FACILITIES

Draft (X)

Final ( )

Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

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EXECUTIVE SUMMARY

PART A - NEED FOR ACTION

This EIS is being prepared by the U.S. Environmental Protection Agency (USEPA) Region IV to address the provision of federal funds for the construction of wastewater management facilities in South Escambia and Santa Rosa Counties, Florida. This area is located in northwestern coastal Florida, adjacent to Alabama. Pensacola is the metropolitan center of the study area, which also includes the incorporated area of Gulf Breeze, the Gulf Breeze Peninsula, and two barrier islands: Santa Rosa Island and Perdido Key.

Alternatives have been developed and evaluated for this EIS based on the existing sewer service areas in Escambia and Santa Rosa Counties. Projected sewer service areas have also been developed based on projected population densities and proximity to existing service areas. The existing Escambia County service areas that will be considered as components of wastewater management systems are:

o Pensacola - The Pensacola service area is defined as the city of Pensacola plus those populated peripheral zones with collection and transportation facilities that utilize the Pensacola Main Street treatment and disposal facilities and those populated peripheral zones not currently sewered. The area is served by the Main Street plant operating at 50 percent of capacity with discharge to Pensacola Bay.

- Pen Haven - Since the inception of the EIS, this treatment facility has been phased out, with flows from the service area conveyed to the Main Street plant.

- Avondale - An existing sewered area adjacent to Pensacola currently served by a secondary treatment facility discharging to the Bayou Marcus. Wastewater flow to the plant equals its capacity. This facility is under a consent decree to close by September 1, 1985. Some flows are already being diverted to the Main Street plant.

- Warrington - An existing sewered area on the southwest fringe of Pensacola served by a secondary treatment facility with flow at 70 percent of capacity. Plant effluent discharges to Bayou Chico Creek.

- Moreno Courts - An existing sewered area on the southwest fringe of Pensacola just south of the Warrington service area. This area is served by a secondary treatment facility operating at approximately 60 percent of capacity with discharge to percolation ponds adjacent to Bayou Chico Creek.

- Scenic Hills - A sewered area just north of Pensacola served by a secondary treatment facility operating at 30 percent of capacity with discharge to land application.

Sewer service areas in Santa Rosa County are less extensive than those in Escambia County; however, wastewater management needs are projected to increase significantly by the year 2000. Santa Rosa County service areas that will be considered as components of wastewater management systems are:

- Gulf Breeze - The Gulf Breeze service area is the major service area of the Santa Rosa County portion of the study area, located on the western end of the Gulf Breeze Peninsula. This service area encompasses the incorporated area of Gulf Breeze and the adjacent unincorporated area and is served by the Gulf Breeze treatment plant operating at approximately 50 percent capacity and discharging to Santa Rosa Sound.

- Pensacola Beach - Pensacola Beach represents the only relatively densely populated service area on Santa Rosa Island. This area is served by a secondary treatment plant currently operating at capacity and discharging to Santa Rosa Sound. Although Pensacola Beach is located in Escambia County, this service area is evaluated with the Santa Rosa County service areas because of its location.

- Navarre Beach - The Navarre Beach service area is located in the eastern portion of Santa Rosa Island and is served by a secondary treatment plant discharging to Santa Rosa Sound.

- Santa Rosa Shores - The Santa Rosa Shores subdivision on the Gulf Breeze Peninsula is served by a small-scale treatment plant with spray irrigation to a local golf course.

In 1978, the local applicants completed preparation of a 201 Wastewater Facilities Plan. The Plan proposed an extensive and costly regional system. Two new regional plants were proposed, one in southwest Escambia County with discharge by outfall into the Gulf of Mexico and one in southern Santa Rosa County with discharge by load application at Eglin Air Force Base. The plan became controversial due to a high potential for growth in environmentally sensitive areas. The most controversy centered on the barrier islands of Perdido Key and Santa Rosa Island. The 201 Plan was based on the assumption that extensive resort oriented growth would occur on these islands. This 201 Plan generated five central issues which are addressed in the EIS. These issues are:

1. Concerns about the impacts of new development promoted by federally supported wastewater facilities on environmentally sensitive coastal areas, including wetlands, floodplains and two barrier islands

2. Inconsistencies in the population projections between the 201 Plan and the approved 208 Plan

3. Concern over the construction and operation impacts of the 201 proposed Gulf outfall for the developing southwestern portion of the study area

4. The viability of the 201 proposed land application site on the Eglin Air Force Base to serve the Gulf Breeze peninsula and Santa Rosa Island

5. The protection of sensitive estuarine and recreational waters.

Because of the controversy surrounding the 201 Plan and potential impacts to environmentally sensitive areas, the Environmental Protection Agency (EPA) decided to prepare an EIS with respect to wastewater management facilities to serve South Escambia and Santa Rosa Counties. Subsequently a Notice of Intent to conduct the EIS was issued by the EPA Regional Administrator in May of 1980.

PART B - DESCRIPTION OF THE ALTERNATIVES

Projected populations and wastewater flows were developed for the study area. Feasible alternatives were then developed by combining wastewater service configurations with treatment and disposal options. The remainder of this section presents a description of the final set of alternatives for wastewater management which were evaluated in the EIS.

1. Escambia County

Alternative 1

This alternative provides centralized wastewater service with a new Southwest County treatment plant. This plant would have secondary treatment with discharge by outfall to the Gulf of Mexico. This is the 201 Alternative which includes the Avondale, Pen Haven, Warrington, Northwest, Perdido Key and Southwest Escambia service areas with a combined flow of 7.7 mgd.

Alternative 2

This alternative provides centralized wastewater service with new treatment plants for the Southwest County and Perdido Key areas. The Southwest County treatment plant would have secondary treatment with discharge by land application. The capacity of this plant would be 0.54 mgd with 50 percent of the area's population served. The Perdido Key treatment plant would have secondary treatment with discharge by land application. Projected capacity is 1.7 mgd with 100 percent of the population sewered. The Warrington, Avondale and Moreno Courts treatment plants would be phased out with flows conveyed to the Main Street plant for treatment and disposal. Centralized sewer service would be provided to the Northwest area with conveyance to the Main Street plant for treatment and disposal.

Alternative 3

This alternative continues current wastewater management practices of use of package plants and septic tanks in Southwest County, Perdido Key and Northwest County. The Warrington, Avondale and Moreno Courts treatment plants would be phased out with flows conveyed to the Main Street plant for treatment and disposal.

2. Santa Rosa Island/Gulf Breeze Peninsula

Alternative 1

This is the 201 Plan Alternative. A new regional plant would be constructed on the eastern end of the Gulf Breeze Peninsula with disposal by land application at the Eglin Air Force Base. Capacity of the plant would be 8.0 mgd with secondary treatment. The plant would treat flows from Gulf Breeze, Pensacola Beach and Navarre Beach.

Alternative 2

This alternative would convey flows from Pensacola Beach and Gulf Breeze to the Main Street plant for treatment and disposal. Flows from Navarre Beach would be treated at the existing treatment plant with land application.

Alternative 3

This alternative involves expansion of the Pensacola Beach plant to 2.4 mgd with the existing level of treatment and discharge point. Class 1 reliability will be provided. The existing plant at Navarre Beach would remain at its current capacity. The City of Gulf Breeze would continue treatment and disposal at the existing location with expansion from 0.5 to 0.8 mgd. The continued use of package plants and septic tanks is projected for the Gulf Breeze Peninsula.

Alternative 4

This alternative conveys flows from Pensacola Beach and Gulf Breeze to Pensacola Bay following treatment at Gulf Breeze. Flows from Navarre Beach would be treated at the existing plant with discharge by land application.

PART C - EVALUATION OF ALTERNATIVES

The alternatives described in Part B were evaluated in terms of cost, operability, implementability, and environmental impact. A summary of the evaluation is presented below:

1. Cost

Escambia County:
Alternative 1 - $64.8 million
Alternative 2 - $25.3 million
Alternative 3 - $9.0 million

Santa Rosa County:
Alternative 1 - $36.9 million
Alternative 2 - $17.3 million
Alternative 3 - $7.4 million
Alterantive 4 - $10.8 million

2. Operability

Operability considerations do not eliminate any of the final alternatives. If wastewater is conveyed to a regional facility rather than continuing operation of several smaller treatment plants, both operability and reliability may be improved due to increased staff size and newness of the facility. However, no significant long term problems have resulted from the operation of the existing facilities.

3. Implementability

The Main Street treatment plant as well as the Avondale and Warrington facilities are under the control of the Escambia County Utilities Authority. Therefore, no implementation problems are involved with the diversion of these flows to Main Street. The Moreno Courts treatment plant is under the jurisdiction of the Pensacola Housing Authority but few implementation problems are anticipated if the Authority chooses to participate in the recommended action. Implementation of the Gulf outfall alternative will be more difficult than other options due to the uncertainties associated with siting and constructing the outfall. In the Santa Rosa area, the local alternative is considered to be the most implementable because there would be no need for coordination of facilities construction, expansion, or operation with these other local authorities. The implementability of the 201 alternative is questionable due to the lack of a suitable site for land disposal of the effluent.

4. Environmental Impacts

Based on the environmental analysis, extensive water quality problems resulting from most existing discharges have not been documented. The existing Avondale and Warrington treatment plants, however, are causing problems now and will be eliminated under all the alternatives. Further, data to assess fully the impacts of the Main Street plant on Pensacola Bay are still being collected. The construction of new regionalized systems with capacity for significant amounts of growth, could have the potential to induce environmental impacts. The sensitive barrier island, wetland, and estuarine environments would be subject to intensive developmental pressure. The comprehensive land use and development controls which would be necessary to protect environmental quality are not in place. The area most likely to experience significant adverse environmental impacts is Perdido Key where

Escambia County is projecting and encouraging a population increase from 3,432 to 36,710 over the next two decades.

PART D - DESCRIPTION OF THE PREFERRED ALTERNATIVE

1. Escambia County

The conveyance of flows from the Warrington and Avondale service areas to the Main Street plant is recommended. This option removes wastewater discharges to Bayou Chico and Bayou Marcus Creek which will improve water quality and meet the objectives of the Florida Department of Environmental Regulation. Further, it is recommended that the Moreno Courts effluent also be conveyed to Main Street given the elevated nitrogen levels observed in percolation pond monitoring wells, proximity of percolation ponds to Jones Swamp Creek-Bayou Chico, direction of groundwater flow toward the creek, documented water quality problems in Bayou Chico and proximity of the Warrington conveyance lines. Based on current flows and conveyances from the three treatment plants recommended for action, the Main Street plant should have sufficient capacity. This proposed action is not anticipated to exceed the projected capacity of the Main Street plant and is not intended to lead to such action. EPA funding will be made available for these water quality improvement actions if within reach on the state priority list.

The continuation of current wastewater management practices is recommended for the Southwest County, Perdido Key and Northwest County areas. No significant water quality or public health problems have been documented or are projected in these areas assuming applicable permitting procedures are followed. As the density of development increases, however, setback requirements and distances between percolation ponds will be more critical and these factors should be emphasized by DER in their permitting process. The recommended action avoids encouraging higher population densities which would increase the stress on water quality, wetlands and the sensitive barrier island environment. It is important to note that the assessment that current practices are and should be adequate in the Southwest, Northwest and Perdido Key areas, leading to the No Action decision, is based on 208 population projections which are the basis for EPA decision making. Current wastewater management practices might not be adequate for population levels greater than projected by the 208 Plan.

2. Santa Rosa County

The continuation of current wastewater managment practices is recommended for Santa Rosa Island and the Gulf Breeze Peninsula. All discharges in this area are currently meeting their effluent limits. No significant water quality or public health problems have been documented which would justify the construction of major new facilities. The provision of regional systems with additional capacity could encourage growth and development of the sensitive barrier island environment. Expansion of existing facilities at local expense to accommodate growth is expected.

If future changes to effluent limits for Santa Rosa Sound require no discharge or very stringent treatment levels that are not cost-effective to meet at each small plant, conveyance of secondary effluent to Pensacola Bay for discharge should be reconsidered. Should such a system be implemented in the future, EPA should reassess the potential for significant stimulation of development of sensitive areas in making grant participation decisions.

CHAPTER I - PURPOSE AND NEED FOR ACTION

A. Purpose of the EIS

Concerns within the past decade for preservation of the integrity of the environment led to the adoption of Public Law 91-190, the National Environmental Policy Act (NEPA) of 1969. Within this Act are the national environmental policies and goals intended to mitigate mistakes of the past through careful and coordinated planning efforts. As stated in the law the following declaration was issued: "a national policy shall be established which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological system and natural resources important to the Nation..."

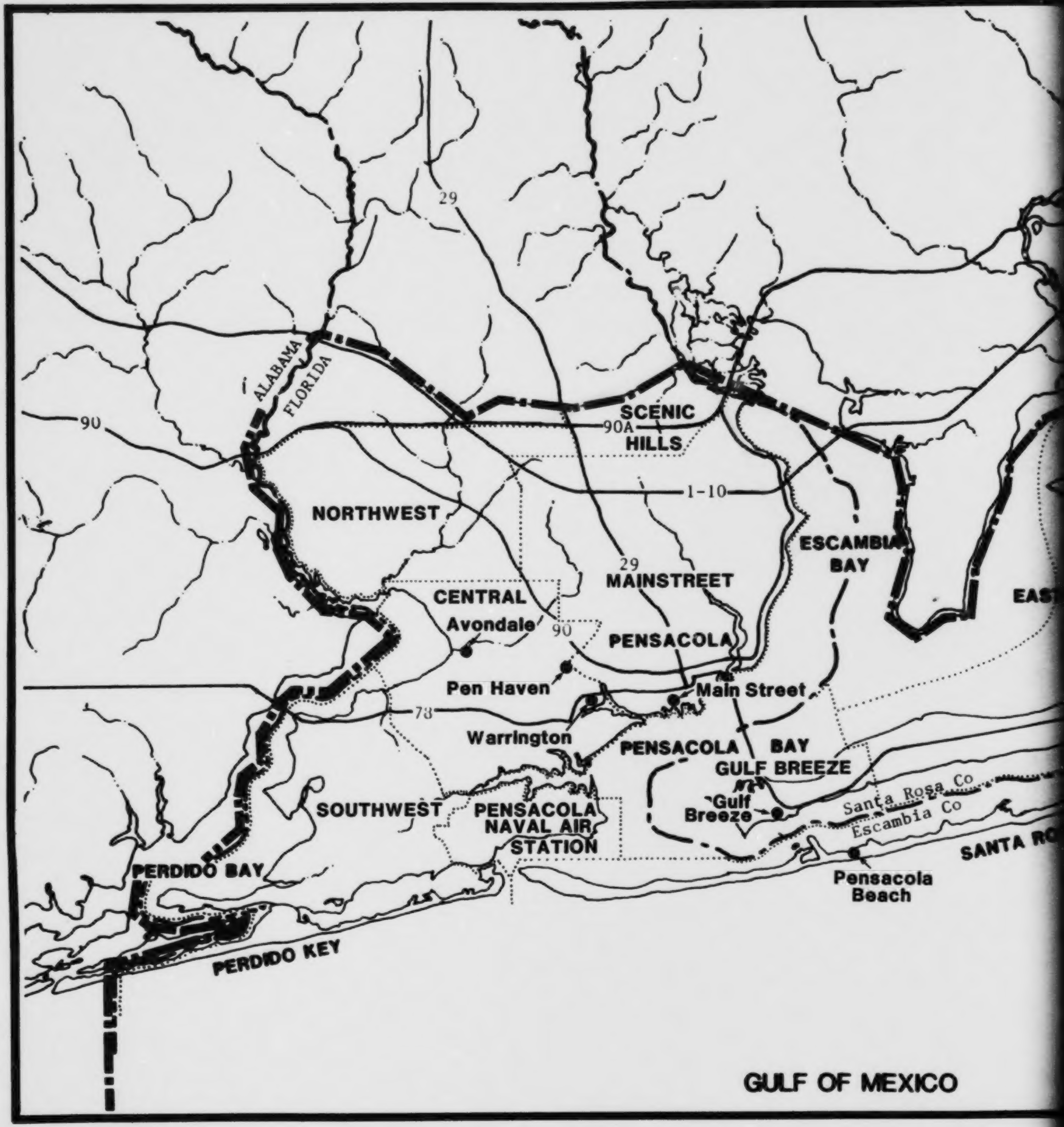
In striving to meet these above stated goals P.L. 91-190 stipulates: "...include in every recommendation a report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on the environmental impact of the proposed action; and adverse environmental effects which cannot be avoided should the proposal be implemented; and alternatives to the proposed actions..." From this legislation arises the basic framework for the use of the Environmental Impact Statement (EIS).

The purpose of this particular EIS is to inform the public of potential impacts which may result from the proposed Federal action, and to enable public participation in the decision making process. The EIS is intended to resolve conflicts in the study area between wastewater disposal and the unique natural resources which exist in this area.

The EIS proposes to develop a preferred alternative for wastewater facilities in the study area which will minimize environmental impacts throughout the study area.

B. Background and Issues

This EIS is being prepared by the U.S. Environmental Protection Agency (EPA) Region IV to address the provision of federal funds for the construction of wastewater management facilities in South Escambia and Santa Rosa Counties, Florida. This area is located in northwestern coastal Florida, adjacent to Alabama. Pensacola is the metropolitan center of the study area, which also includes the incorporated area of Gulf Breeze. This EIS was begun in June 1980. Work proceeded smoothly through the completion of the Alternatives Evaluation Report and Perdido Key Case Study by March 1982. Little activity occurred during the following 18 months. Efforts to complete the EIS resumed during October 1983, leading to action by the EPA Region IV Administrator in January 1984. Urbanization has occurred in recent years northeast and northwest of Pensacola and along the coast, including the adjacent barrier islands, Santa Rosa Island (Pensacola Beach) and Perdido Key. Large portions of Southwest Escambia County are located in sensitive floodplains and wetlands. The study area for this EIS includes the city of Pensacola and the adjacent suburban areas, Southwest Escambia County, the Gulf Breeze Peninsula, Santa Rosa Island, and the Florida portion of Perdido Key.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SOUTH ESCAMBIA AND SANTA ROSA COUNTIES E.I.S.

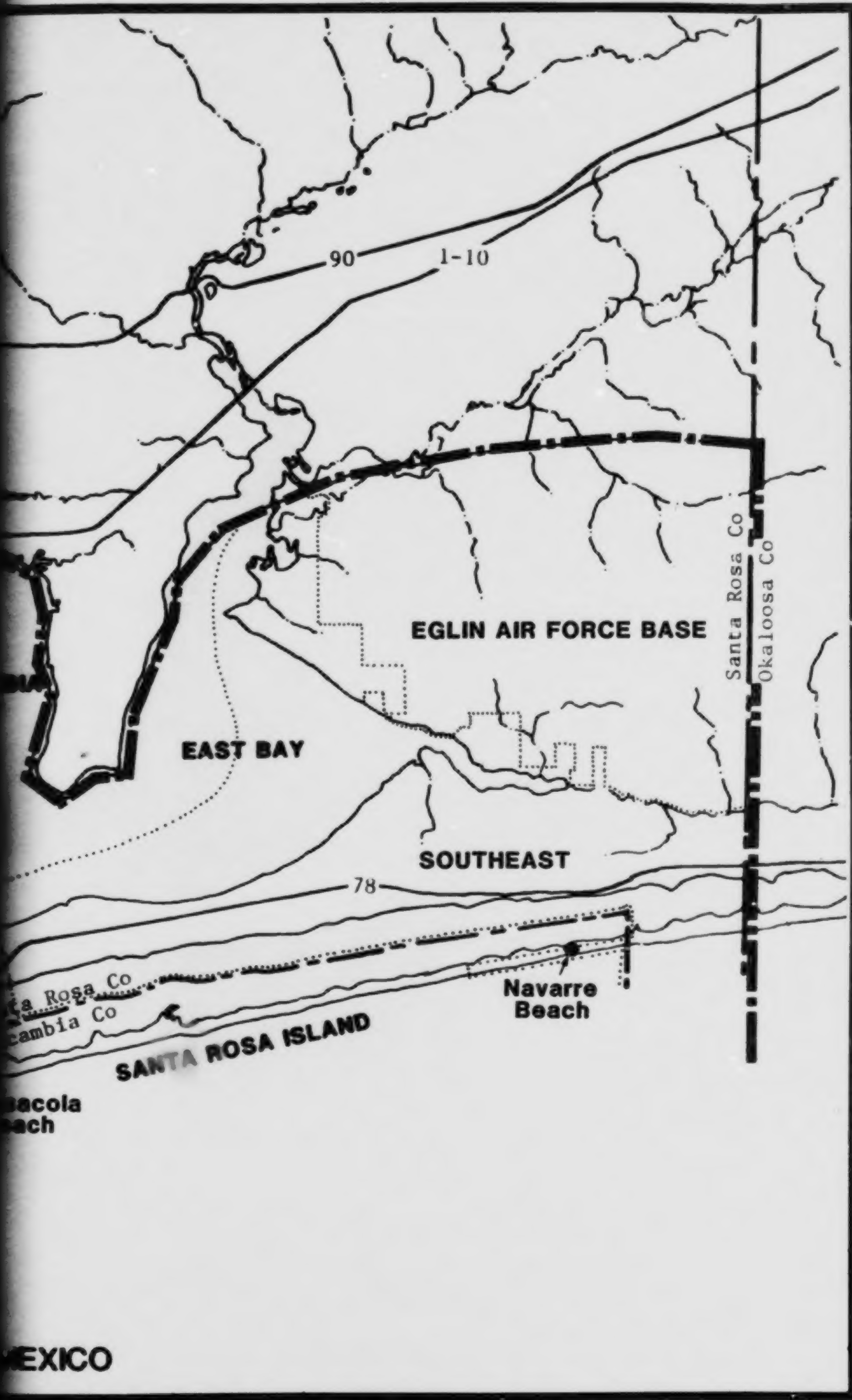
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Figure I-1

EIS Study Area

● Existing Wastewater Plants

N

Wastewater facilities planning studies were initiated in 1975 in response to the projected population growth and wastewater management needs of the Pensacola Region. Six governmental entities were involved in the initial planning efforts:

- Escambia County, acting officially through its Commission
- Santa Rosa County, acting officially through its Commission
- City of Pensacola, acting officially through its Council
- City of Gulf Breeze, acting officially through its Council
- Santa Rosa Island Authority, acting officially through its Board of Directors
- Santa Rosa County Beach Administration (later changed to the Navarre Beach Advisory Council), acting officially through its Board of Directors.

Through official enabling resolutions, the six governmental entities formed a steering committee with responsibility for 201 planning policy decisions and named the City of Pensacola as the lead agent for receiving and disbursing federal grants. A consortium of five consultants was assembled to prepare the 201 Facilities Plan. This consortium included:

- Consoer, Townsend & Associates (Escambia County)
- Baskerville-Donovan Engineers, Inc. (Santa Rosa County, City of Gulf Breeze, and the Santa Rosa County Beach Administration)
- Flood & Associates, Inc. (City of Pensacola)
- Tom Justice & Associates (Santa Rosa Island Authority)
- Theta Analysis, Inc. (environmental consultants representing all participants).

Actual wastewater facilities planning efforts were undertaken in early 1976, culminating in the completion of a Draft 201 Facilities Plan in April 1978.

The EIS was initiated in response to a number of issues raised by EPA during review of the 201 Facilities Plan. A summary of these issues follows:

1. Impact of Federal Funding on Sensitive Coastal Areas--New policies have been and are being established concerning development on barrier islands and sensitive coastal areas, primarily floodplains and wetlands. Since wastewater treatment systems act to support and in some cases initiate development, they are important in the context of barrier island and coastal development policy.

2. Population Projections--Discrepancies between population disaggregations and projections in the 201 Facilities Plan and the 208 Areawide Water

Quality Management Plan necessitated further review by EPA. Population projections used in the 201 Facilities Plan for Southwest Escambia County and the barrier islands were considered developmental in nature and did not adequately reflect environmental concerns.

3. Viability of Septic Tanks and Percolation Ponds in Coastal Areas--Further analysis was considered necessary by EPA to determine the environmental acceptability of septic tanks and percolation ponds on barrier islands and in adjacent coastal areas.

4. Gulf Outfall--A Gulf outfall was recommended for a new Southwest Escambia Wastewater Treatment Plant proposed in the 201 Facilities Plan. Before this alternative could be accepted, additional studies were considered necessary to further evaluate the environmental impacts.

5. Land Application--Land application was recommended for a new South Santa Rosa County Wastewater Treatment Plant proposed in the 201 Facilities Plan. Further analysis was considered necessary to determine the availability of suitable land application sites in this area before this alternative could be accepted.

C. 201 Facilities Plan Summary

The 201 Facilities Plan prepared for South Escambia and Santa Rosa Counties produced the following recommendations:

- Completion of construction of the Main Street (City of Pensacola) Wastewater Treatment Plant with a design capacity of 20.0 mgd, advanced wastewater treatment, and disposal to Pensacola Bay. (This work was completed in 1979.)
- Construction of a 11.3 mgd facility to serve Southwest Escambia County, secondary treatment, and disposal via a Gulf outfall
- Construction of a 8.0 mgd facility to serve South Santa Rosa County, secondary treatment, and disposal via low-rate landspreading
- Construction of required pumping stations and force mains to provide service to the 201 planning area.

CHAPTER II - ALTERNATIVES DEVELOPMENT AND EVALUATION

A. Introduction

The purpose of this chapter is to provide a systematic development of all reasonable wastewater management alternatives and to compare these alternatives with the aim of identifying critical differences and selecting a preferred wastewater management alternative. Wastewater flow projections form the basis for alternatives development and have been analyzed specifically for this EIS. In addition, treatment, collection and disposal options have been identified based on the existing environment and needs of the study area. Finally, specific wastewater management alternatives have been developed using the projected wastewater flow and identified options. Regional, Subregional, and Local Alternatives have been developed separately for the Escambia County and Santa Rosa County portions of the study area. No Federal Action Alternatives have also been developed.

B. Wastewater Flow Projections

Wastewater flow projections are a key issue in any wastewater management study because they affect the staging, siting and capacity of wastewater management facilities. Wastewater flows were developed specifically for this EIS since population and development assumptions developed as part of the 208 Plan and incorporated into this EIS differed significantly from those used in the 201 Facilities Plan. Wastewater flows are analyzed according to existing and projected sewer service areas.

1. Sewer Service Areas

Alternatives have been developed and evaluated for this EIS based on the existing sewer service areas in Escambia and Santa Rosa Counties. Projected sewer service areas have also been developed based on projected population densities and proximity to existing service areas. The existing Escambia County service areas that will be considered as components of wastewater management systems are:

- Pensacola - The Pensacola service area is defined as the city of Pensacola plus those populated peripheral zones with collection and transportation facilities which utilize the Pensacola Main Street treatment and disposal facilities and those populated peripheral zones not currently sewered. The area is served by the Main Street plant operating at 50 percent of capacity with discharge to Pensacola Bay.

- Pen Haven - Since the inception of the EIS, this treatment facility has been phased out, with flows from the service area conveyed to the Main Street plant.

- Avondale - An existing sewered area adjacent to Pensacola currently served by a secondary treatment facility discharging to the Bayou Marcus. Wastewater flow to the plant equals its capacity. This facility is under a consent decree to close by September 1, 1985. Some flows are already being diverted to the Main Street plant.

- Warrington - An existing sewered area on the southwest fringe of Pensacola served by a secondary treatment facility with flow at 70 percent of capacity. Plant effluent discharges to Bauou Marcus Creek.

- Moreno Courts - An existing sewered area on the southwest fringe of Pensacola just south of the Warrington service area. This area is served by a secondary treatment facility operating at approximately 60 percent of capacity with discharge to percolation ponds adjacent to Bayou Marcus Creek.

- Scenic Hills - A sewered area just north of Pensacola served by a secondary treatment facility operating at 30 percent of capacity with discharge to land application.

Figure II-1 delineates the sewer service areas used for alternatives development. The northwest and southwest areas are projected sewer service areas, with Pen Haven, Avondale, Warrington, and Moreno Courts composing the central area.

Sewer service areas in Santa Rosa County are less extensive than those in Escambia County; however, wastewater management needs are projected to increase significantly by the year 2000. Santa Rosa County service areas that will be considered as components of wastewater management systems are:

- Gulf Breeze - The Gulf Breeze service area is the major service area of the Santa Rosa County portion of the study area, located on the western end of the Gulf Breeze Peninsula. This service area encompasses the incorporated area of Gulf Breeze and the adjacent unincorporated area and is served by the Gulf Breeze treatment plant operating at approximately 50 percent capacity and discharging to Santa Rosa Sound.

- Pensacola Beach - Pensacola Beach represents the only relatively densely populated service area on Santa Rosa Island. This area is served by a secondary treatment plant currently operating at capacity and discharging to Santa Rosa Sound. Although Pensacola Beach is located in Escambia County, this service area is evaluated with the Santa Rosa County service areas because of its location.

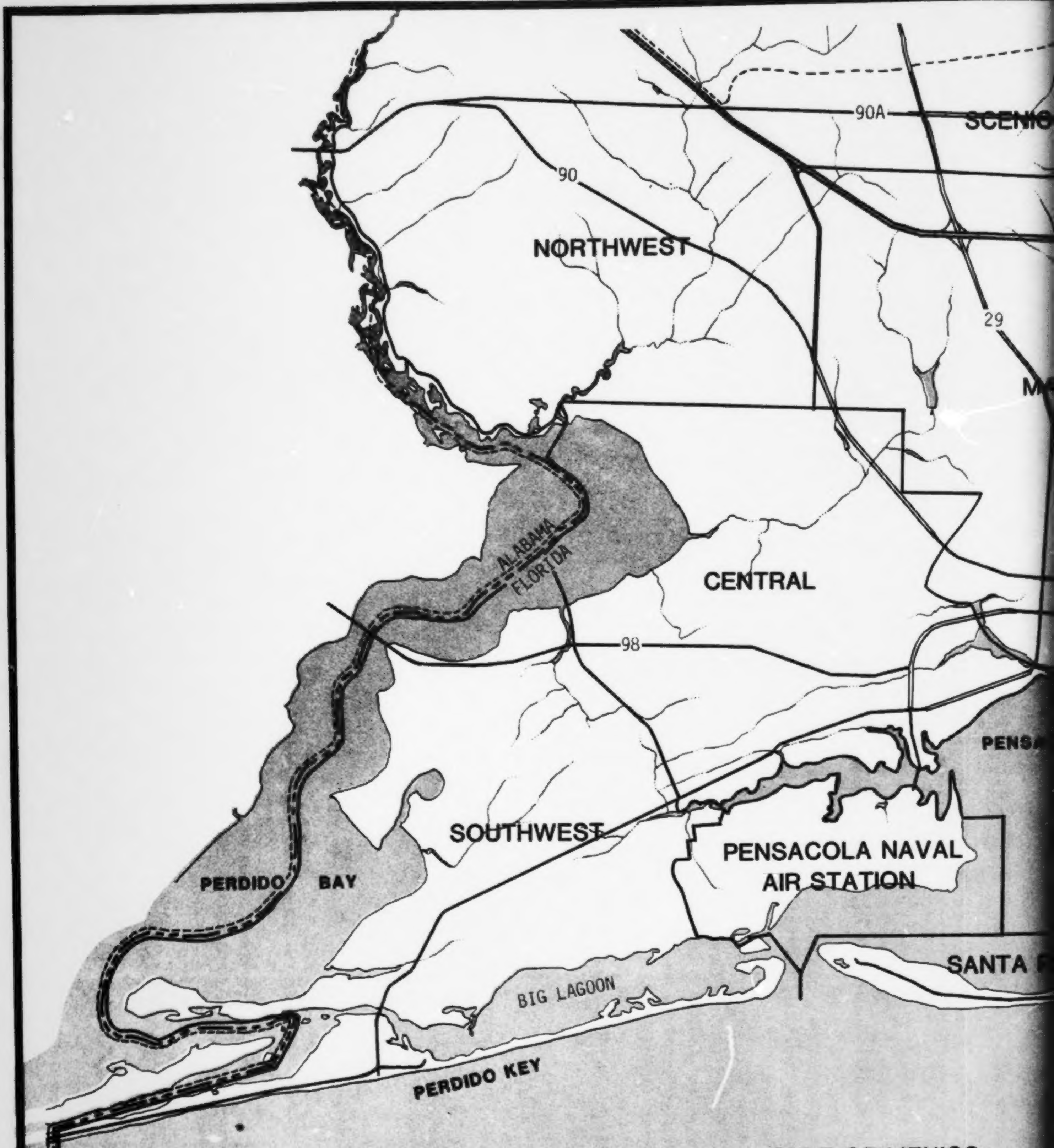
- Navarre Beach - The Navarre Beach service area is located in the eastern portion of Santa Rosa Island and is served by a secondary treatment plant discharging to Santa Rosa Sound.

- Santa Rosa Shores - The Santa Rosa Shores subdivision on the Gulf Breeze Peninsula is served by a small-scale treatment plant with spray irrigation to a local golf course.

Figure II-2 delineates the sewer service areas in Santa Rosa County. Navarre Beach and Santa Rosa Shores are included in the southeast service area.

2. Land Use and Development Compatibility

An analysis of existing and future land use was conducted in relation to several environmental parameters. This analysis provided an indication of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PENSA
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BIG LAGOON
PERDIDO KEY
GULF OF MEXICO

SOUTH ESCAMBIA AND SANTA ROSA COUNTIES E.I.S.

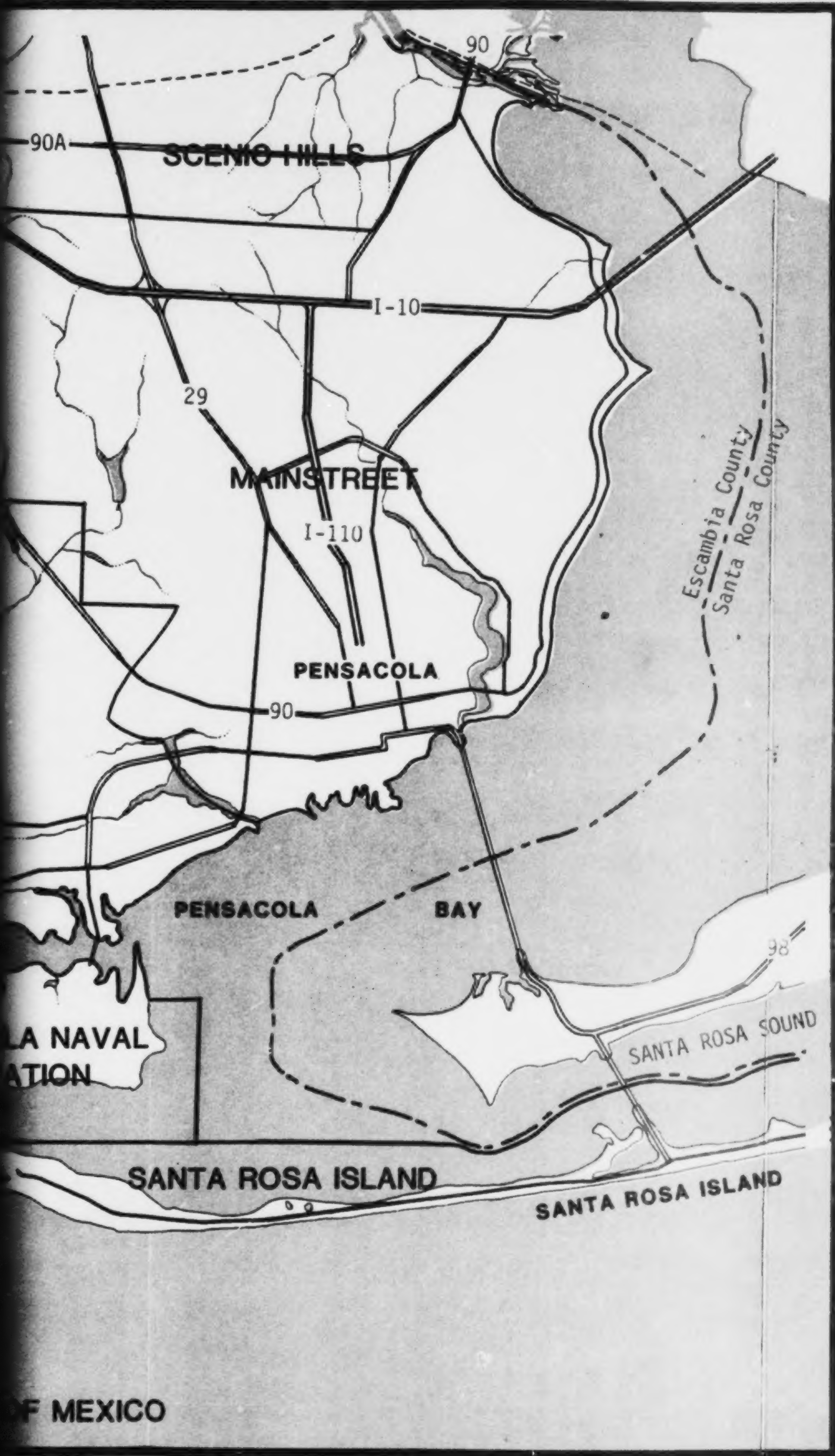
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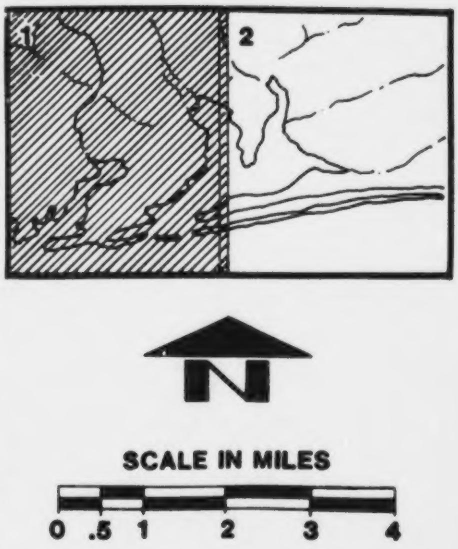
Figure II-1.
Escambia County
Sewer Service Areas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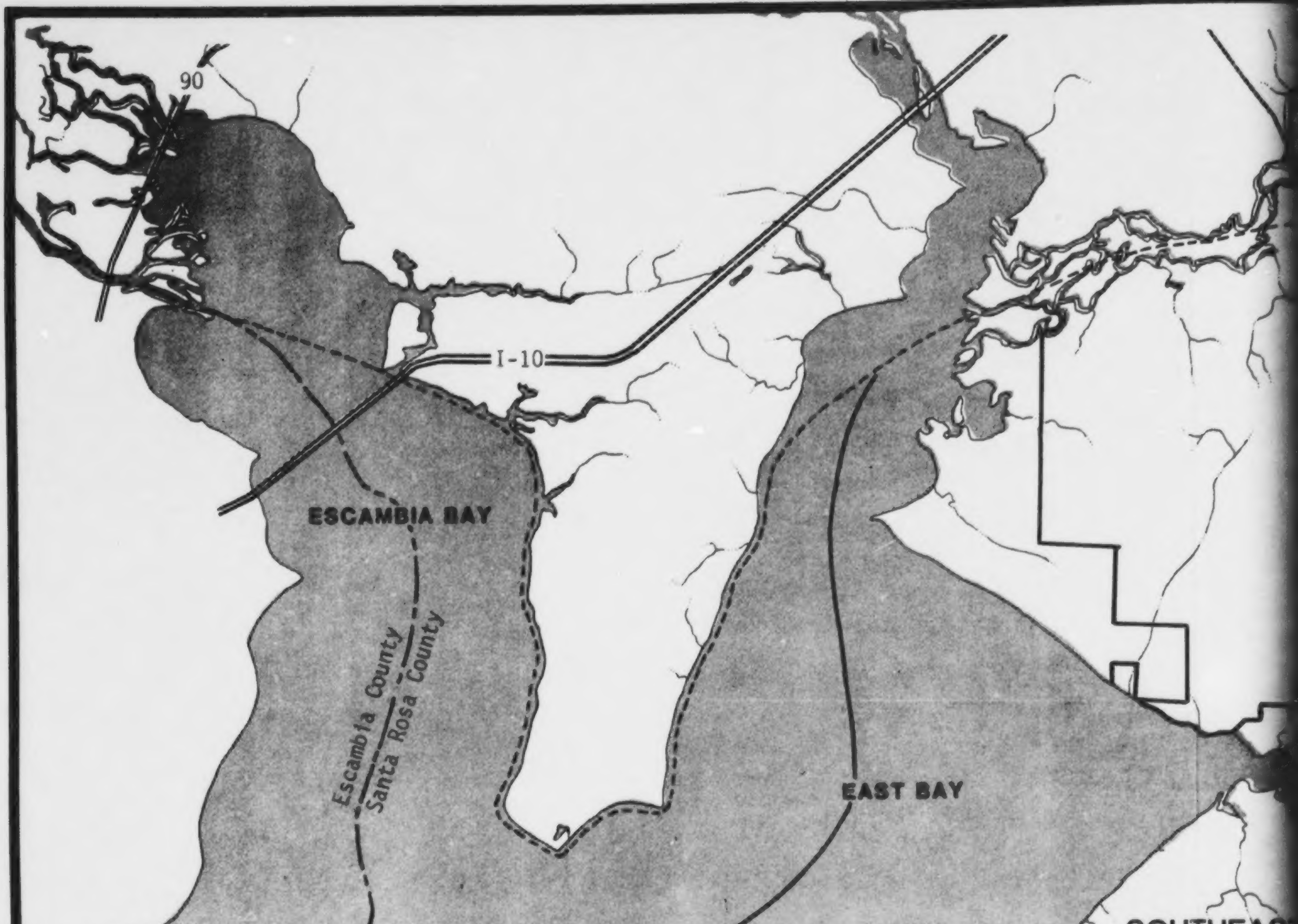
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GULF BREEZE
SANTA ROSA ISLAND

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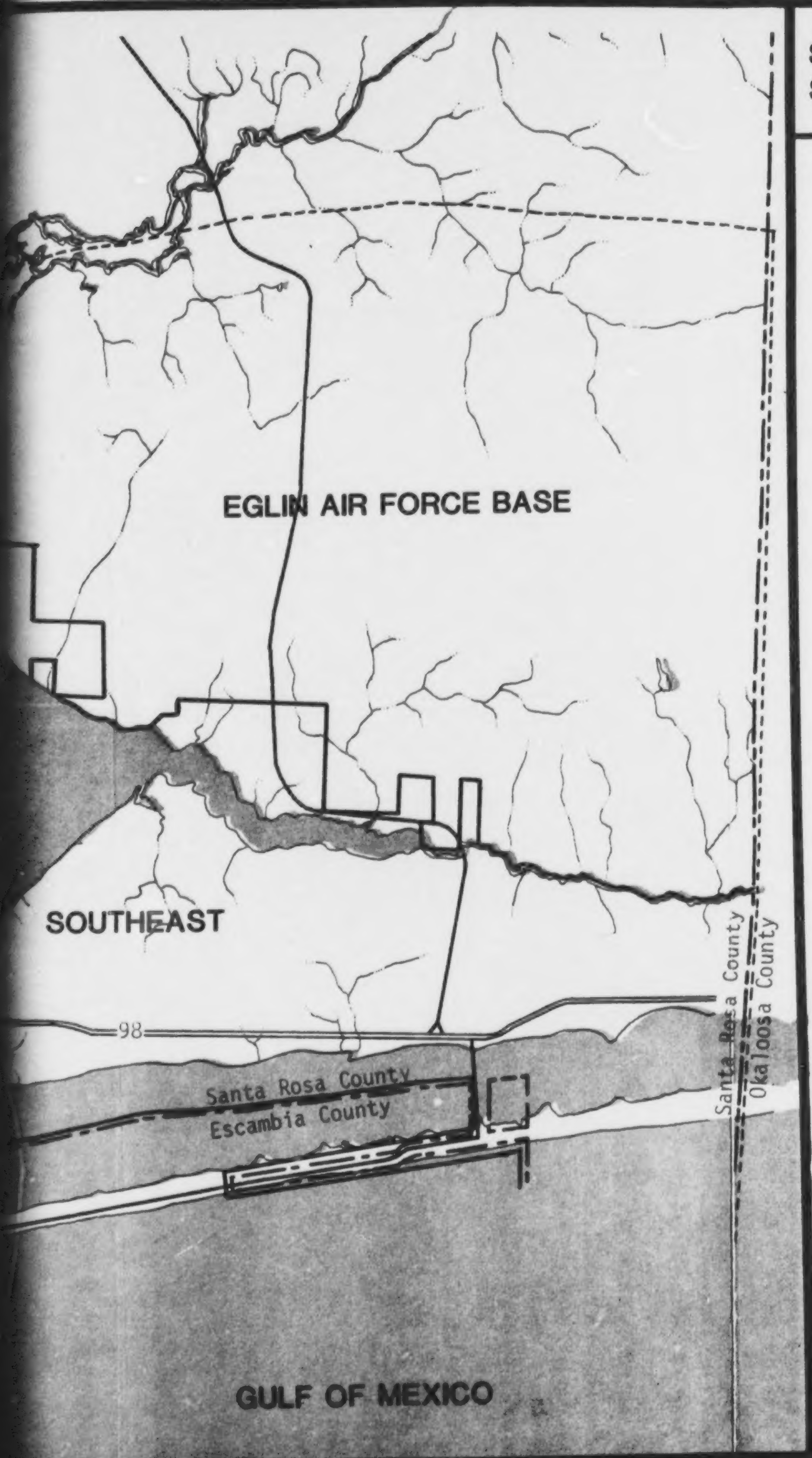
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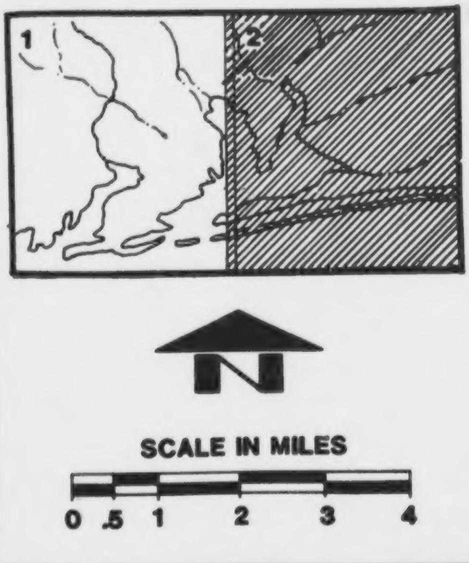
Santa Rosa County
Escambia County
Santa Rosa County
Okaloosa County
GULF OF MEXICO

SOUTH ESCAMBIA AND SANTA ROSA COUNTIES E.I.S.

Figure II-2.
Santa Rosa County
Sewer Service Areas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the extent of existing development in noncompatible areas (primarily floodplains and wetlands) and the ability of suitable areas to support projected development. This analysis was further used to determine the areas suitable for development with on-site wastewater management systems.

For this analysis, noncompatible land features, primarily floodplains and wetlands, were mapped on clear plastic overlays using U.S. Geological Survey topographic maps (1:24,000 scale) as base maps. Maps of the 100-year floodplains were obtained from the National Flood Insurance Program of the U.S. Department of Housing and Urban Development. Wetlands were delineated from land use maps obtained from the West Florida Regional Planning Council in Pensacola. Lands having soils with severe limitations for development because of excessive wetness, high water table, flooding, and/or steep slopes were also delineated. Soils maps were obtained from the U.S. Department of Agriculture soil survey reports for Escambia and Santa Rosa Counties (USDA 1960, 1980). Existing land use overlays were prepared from maps obtained from the West Florida Regional Planning Council. These existing land use overlays were then verified and updated from aerial photographs taken in November 1979 and contained in the EPA Region IV Gulf Coastal Inventory (EMSL-LV Project AMD 8028).

In order to facilitate graphic display of the above mentioned information, the various data overlays were encoded in order to produce computer-generated data maps. This exercise allowed greater flexibility and precision in terms of data analysis and reproduction. In addition, accurate acreage totals were derived from the various land use and environmental categories.

Identification of existing development in noncompatible areas is an important consideration for wastewater facilities funding since several federal regulations and policy directives preclude federal support or subsidies in these areas. Executive Order 11990 (May 24, 1977) requires special consideration of federally financed or assisted construction in wetland areas. Executive Order 11988 (May 24, 1977) requires similar consideration and protection of floodplains. EPA regulations implementing the 201 Program and regulations implementing the NEPA also require that impacts to sensitive areas be considered.

An analysis of computer-generated cross-tabulations indicates approximately 6,384 developed acres in the Pensacola area are located within the 100-year floodplain, as delineated by the U.S. Department of Housing and Urban Development. An additional 501 developed acres are located in identified wetlands. The majority of these noncompatible developed areas are located on the barrier islands (Santa Rosa Island and Perdido Key) and the near-coastal areas of downtown. Additional flood hazard areas are adjacent to Bayou Texar, Bayou Chico and Bayou Grande. These acreage figures do not include government-owned or institutional lands such as golf courses, military facilities and areas included in the Gulf Islands National Seashore.

A computer-generated, cross-tabulation of vacant areas, flood hazard areas and soils with severe limitations provides an indication of vacant areas suitable for development with on-site septic systems and sewers. Vacant areas not located in flood hazard areas or in areas with severely limited soils are considered suitable for development with septic tanks. (Severely limited soils were mapped from U.S. Soil Conservation Service soil maps and include areas of severe slope, seasonally high water table, or other limitations for on-site wastewater disposal). Vacant areas not located in flood hazard areas but located in areas with severely limited soils are considered suitable for development with sewers. Wetlands were automatically excluded from consideration for development because vacant land and wetlands were mapped on the same overlay and were, therefore, mutually exclusive.

A total of approximately 45,234 acres in the study area is classified as vacant land suitable for development. Of this total, approximately 25,398 acres (56 percent) are suitable for on-site wastewater disposal, based on soils analysis. The majority of this vacant, developable acreage is located in western and southwestern Escambia County and the Gulf Breeze Peninsula. Disaggregation of these acreage figures by centroid and a correlation with existing sewer service areas indicate where future development can use on-site wastewater disposal systems and where additional sewers and possibly expanded treatment plants may be needed.

This analysis of areas suitable for future development illustrates the necessity of development controls. Through zoning, development can be directed into the most suitable areas: low-density, residential uses could be zoned in areas suitable for on-site septic tanks, while higher density uses could be zoned in areas where sewers are available. Most vacant land in the study area is currently unzoned.

The overlay analysis described above was used to provide an estimate of population that could potentially use on-site systems in the year 2000, since sewer service may be necessary where on-site service is not feasible. All alternatives proposed have sufficient capacity so that projected populations will have either sewer service or available land that is suitable for on-site systems.

The following process provides an estimate of future population growth that can be served by on-site systems on presently vacant land. Population served by existing sewers, and related information were determined for each centroid within each service area. Data computations, in sequence, consisted of:

Total population for each centroid in a service area

Percent of developed area in a service area

Percent of area in a centroid which is served by sewers

Permanent population served by sewers

Percent of population served by sewers

Tourist population served by sewers

Total population served by sewers.

Subsequently, year 2000 populations in the service area were estimated by multiplying total year 2000 populations by the percentage of populated areas in each service area.

The percentage of each centroid area in a service area was estimated and applied to the centroid acreages that are suitable for on-site systems. The sum of these gave the acreage available for on-site systems in each service area. The additional (future) population that can be served by on-site systems on presently vacant land results from the following calculation:

> Acreage available x 4 houses per acre x people per household (based on 1980 census) x 0.8 (factor to allow for future commercial growth on vacant land) = carrying capacity in service area for future on-site use.

In many areas, population growth will exceed available land suitable for on-site disposal. Sufficient sewer service has been estimated for such areas in order to preclude this. Table II-1 presents the level of increased populations in service areas between 1980 and 2000 and lists the additional populations that can use on-site systems by service area. The bases for population projections are discussed below.

3. Population

Since EPA population projections are given on a county basis, a method of disaggregating the EPA projections into smaller planning or service areas was required. For this EIS, a methodology was developed based on the population disaggregations contained in the 208 Plan. The 208 population figures tend to show future growth in those areas that are most capable of supporting new growth. Locations that contain sensitive environmental areas or which pose constraints to construction (high water table, wetlands) were considered less suitable for growth. The general effect of this decision was to allocate future growth toward the northern upland portions of the counties away from the marginal lands found adjacent to the ocean and estuarine shorelines.

The disaggregation process used by the 208 program was used by this EIS, since it incorporates elements which reflect federal policies concerning development of floodplain and wetland areas. This disaggregation process will tend to underestimate population in coastal centroids only if land use planning is not instigated. Otherwise, this system represents a more judicious development pattern. In contrast, the population figures used in the 201 Plan did not account for locally planned development but extrapolated heavy development trends in the coastal area reflecting current trends on the barrier islands. In fact, however, growth is continuing on the barrier islands and in the near coastal areas. Local land use controls intended to control growth in coastal areas will still allow a population increase on Perdido Key from 3,432 to 36,710. This causes an inconsistency in actual development trends and the trends proposed by the 208 Plan for the area, which has been approved by EPA. As a result of the 208 Plan approval, funding that would induce development contrary to that delineated by the 208 Plan (which attempts to consider the location of floodplains, wetlands and other vulnerable or sensitive areas) would not be supported.

Continuing growth must be anticipated in coastal areas for secondary/vacation residences as the aesthetic values attract new seasonal residents to the area. The wastewater treatment needs of this population segment are less than the needs of permanent residents. Reduced total wastewater flows result from seasonal use patterns and reduced daily flows since tourists do not use as much water as permanent residents. Seasonal development may therefore require less capital intensive wastewater treatment facilis. Reduced total wastewater flows result from seasonal use patterns and reduced daily flows since tourists do not use as much water as permanent residents. Seasonal development may therefore require less capital intensive wastewater treatment facilities than areas dominated by permanent populations. Seasonal population figures for the study area were disaggregated only for the year 2000. Seasonal population figures were derived from the 1996 seasonal population projections contained in the 201 Facilities Plan.

Reduced environmental impacts are not certain, however, unless reasonable management practices are implemented at the local level. While the 208 and EIS population figures show growth in compatible, attractive locations, this is an assumption based on a willingness to protect critical environmental areas. It may be necessary to draft and enforce local regulations which promote wise use of natural resources in order to preserve the amenities along the coastal area. Failure to do so may allow indiscriminate growth in noncompatible locations, thereby increasing populations in areas where low populations are predicted. This possibility could result in the construction of facilities in sparsely populated areas where growth fails to materialize as anticipated and could also result in a lack of adequate facilities in marginal, fragile locations.

Once the EPA population projections were disaggregated into the centroids delineated in the 208 Plan, the centroid figures were adjusted to correspond to the sewer service areas delineated in the 201 Facilities Plan. The percentage of the populated centroid area included in the 201 Plan service area was determined using a population centroid map as an overlay on the sewer service area map. A uniform density of population was assumed for each populated centroid area in order to arrive at the population in the 201 Plan service area. Then the percentage of the populated 201 Plan service area that has existing sewers was determined. This was used to arrive at the existing collection system service population. Seasonal (tourist) population that is presently served was assumed to be the same percentage of the total population as the year-round residents in each centroid. The total peak population presently served is the sum of the served year-round population plus the served seasonal population.

For purposes of determining future service capacities, additional population data computations were required. It is recognized by U.S. EPA that seasonal populations generate wastewater at a lower per capita rate than permanent populations. Consequently, a population equivalent factor of 0.8 was applied to seasonal populations for the later purpose of determining wastewater flows.

To determine future levels of served and unserved populations, the following assumptions were applied with certain exceptions. Year 2000 served populations are based on the assumptions that:

- All existing served population will continue to be served
- Fifty percent of the existing, unserved population will be connected to sewers (based on existing trends)
- Fifty percent of the population growth will be connected to sewers.

Table II-1. Carrying Capacity of Vacant Lands for Future On-Site Service.

Service Area	1980 Served Population	1980 Unserved Population	Total 1980 Population	Total 2000 Population	Additional Population (4-3)	Additional Population That Can be Served on Vacant Land
Main Street	70,475	67,445	137,920	176,631	38,711	35,813
Warrington	5,497	17,962	23,459	26,064	2,605	811
Pen Haven	3,746	3,121	6,867	9,294	2,427	279
Avondale	6,446	12,034	18,480	24,535	6,055	14,328
Scenic Hills	1,489	9,405	10,894	14,905	4,011	1,977
Gulf Breeze	2,768	6,460	9,228	12,421	3,193	3,068
Pensacola Beach	11,658	-0-	11,658	15,930	4,272	*
Southwest Area	-0-	6,775	6,775	11,090	4,315	18,569
Northwest Area	74	19,063	19,137	26,072	6,935	22,320
Navarre Beach	1,719	-0-	1,719	2,612	893	*
Navarre	-0-	2,156	2,156	2,387	231	19,246
Centroid 53	-0-	922	922	1,461	539	5,491
Gulf Isles	889	553	1,442	2,581	1,139	**
Santa Rosa Shores	896	-0-	896	1,560	664	*
Gulf Br. Peninsula - undesignated	-0-	328	328	355	27	**
Midway	-0-	1,310	1,310	2,387	1,077	**

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* Proposed for 100% service by utilities
**Exceeds column 5

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

Several exceptions are made to the above assumptions. In the case of Warrington, the present strategy envisions a relatively high level of sewer service. In this situation, future served population was projected at a higher level. For the Pen Haven service area the above formula does not provide sufficient sewerage based on available, suitable soils for on-site disposal; therefore, sewer service was increased for this area. On Santa Rosa Island and Gulf Breeze Peninsula, the Pensacola Beach, Navarre Beach, and Santa Rosa Shores service areas are slated for 100 percent service in the future. The Gulf Islands National Seashore, on the other hand, has no existing or projected sewer service areas.

More detailed information concerning the methodologies used for population disaggregation and figures depicting the centroid locations and corresponding populations can be found in the Alternatives Evaluation Task Report.

4. Wastewater Flow Projections

In order to evaluate the individual wastewater management alternatives, wastewater flow projections were developed for each service area. Flow projections for the year 2000 are based on the total residential, commercial and industrial flows as well as infiltration/inflow into the systems.

Residential flows were developed by using the year 2000 equivalent peak residential population (seasonal and permanent residents) and assuming a wastewater generation rate of 80 gallons per capita per day (gpcd). Seasonal population projections were converted to permanent population by multiplying the seasonal figures by 0.8. This factor was based on the relative differences in wastewater generation between seasonal and permanent populations.

Commercial flows for the year 2000 are the sum of commercial flows for 1980 and 9 gpcd allowed for the population growth that occurs between 1980 and 2000.

Future industrial growth is projected only for the Main Street facility. Future industrial flow is represented by the existing industrial flow plus a factor of 10 percent of the residential flow growth allowed for new industry.

Infiltration/Inflow projections are based on existing I/I, 30 percent corrective measures for existing I/I and additional I/I for future systems. In the case of the existing Main Street plant service area, a lower I/I correction factor was used because the City of Pensacola has recently completed a sewer rehabilitation program. Table II-2 presents wastewater flow projections.

5. Effluent Limitations

An important element of analyzing the feasibility and impacts of various wastewater management alternatives is an evaluation of wasteload allocations or effluent limitations. The allowable pollutant loads that can be discharged from a wastewater facility are termed effluent limitations. The regulatory program responsible for setting effluent limitations is the NPDES program. The State of Florida establishes effluent limitations but has not been delegated authority to issue NPDES permits. Table II-3 presents the Florida DER effluent limitations for the major wastewater discharges in the study area.

Table II-2. Escarosa EIS - Wastewater Flow Projections (All flows in million gallons per day)

Service Areas	2000 Pop. Equivalent Served	2000 less 1980 Pop. Equiv. Served	Total Wastewater Flow	Residential Flows	Commercial Flows			Industrial Flows			(I/I)		
					Exist. Major	Add'l.	Total	Exist. Major	Add'l.	Total	Exist. Major	Add'l.	Total
Main Street	120,793	51,788	16.37	9.66	0.56	1.09	1.65	0.19	0.41	0.60	3.68	0.78	4.46
Scenic Hills	8,097	6,619	0.9	0.648	-	0.073	0.073	-	-	0	0.08	0.099	0.179
Avondale	15,386	8,966	1.882	1.23	-	0.138	0.138	-	-	0	0.38	0.134	0.514
Pen Haven	7,429	3,698	1.016	.594	-	0.067	0.067	-	-	0	0.30	0.055	0.355
Warrington	20,226	14,735	2.943	1.62	0.60	0.182	0.782	-	-	0	0.32	0.221	0.541
Southwest Escambia Area	5,196	5,196	0.541	0.416	-	0.047	0.047	-	-	0	-	0.078	0.078
Northwest Escambia Area	12,874	12,800	1.338	1.03	-	0.116	0.116	-	-	0	-	0.192	0.192
Pensacola Beach	13,660	3,810	2.031*	1.09	-	0.123	-0.123	-	-	0	0.246	0.057	0.303
Gulf Breeze	7,405	4,719	0.797	0.592	-	0.067	0.067	-	-	0	0.067	0.071	0.138
Navarre Beach	2,298	811	0.252 *	0.183	-	0.020	0.020	-	-	0	0.037	0.012	0.049
Navarre	1,523	1,523	0.159	0.122	-	0.014	0.014	-	-	0	0	0.023	0.023
Centroid 53	0	0	0	0	-	0	0	-	-	0	-	0	0
Ft.Pickens & St. Park	0	0	0	0	-	0	0	-	-	0	-	0	0
Santa Rosa Shores	1,543	656	0.169	0.123	-	0.014	0.014	-	-	0	0.022	0.010	0.032
Gulf Isles	1,662	815	0.181	0.133	-	0.015	0.015	-	-	0	0.021	0.012	0.033
Midway	1,348	1,348	0.140	0.108	-	0.012	0.012	-	-	0	0	0.020	0.020
Gulf Breeze Peninsula Undesignated	281	281	0.028	0.022	-	0.002	0.002	-	-	0	0	0.004	0.004

*Adjusted to account for the influence of day visitors

Flow Projections Footnotes

Column 3 = Column 4 + 7 + 10 + 13
Column 4 = 80 gpcd x Column 1
Column 6 = 9 gpcd x Column 1
Column 7 = Column 5 + Column 6
Column 9 = 10% x Column 2 x 80 gpcd
Column 10 = Column 8 + Column 9
Column 11 = Use 25 gpcd x 1980 population equivalent for Pensacola Beach, Gulf Breeze, Navarre Beach, Santa Rosa Shores and Gulf Isles.
Column 12 = 15 gpcd x Column 2
Column 13 = Column 11 + Column 12

Table II-3. Effluent Limitations of Existing Wastewater Discharges.

	NPDES					State										
		BOD$_5$		SS			BOD$_5$		SS		TN		TP		Phenol	
Facility	Capacity (mgd)	(mg/l)	(lbs/ day)	(mg/l)	(lbs/ day)	Capacity (mgd)	(mg/l)	(lbs/ day)	(mg/l)	(lbs/ day)	(mg/l)	(lbs/ day)	(mg/l)	(lbs/ day)	(mg/l)	(lbs/ day)
Main Street	20.0	30	2250	30	2250	20.0	-	1334	-	1334	-	1000	-	168	0.05	8.3
Avondale	1.0	24	-	24	-	0.9	20	150	16	121	-	-	-	-	-	-
Warrington	2.0	10	166	10	166	1.4	10	117	10	117	7	82[1]	6	82	-	-
						1.75	10	150	10	150	7	75[1]	6	75	-	-
						2.0[2]	10	167	10	167	5	84[1]	5	84	-	-
Gulf Breeze	0.5	30	224	30	224	0.5	15	62	15	62	-	-	6	-	-	-
Pensacola Beach[3]	1.2	20	200	20	200	1.2	10	100	10	100	-	-	-	-	-	-
Navarre Beach	0.5	30	31	30	21	0.9	5	37.5	5	37.5	9	67.5	5	37.5	-	-

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[1] TKN rather than TN

[2] This flow only allowable after Pen Haven discharge removed

[3] Fecal coliform limitation of 200/100 ml

EISs are based on an important assumption: Effluent limitations adequately protect the uses assigned to a specific water body. Therefore, the development and evaluation of alternatives is based to a large extent on the availability and adequacy of effluent limitations. The State is responsible for establishing effluent limitations that adequately protect uses of waters of the U.S. and the EIS is dependent on this practice.

C. Identification and Development of Wastewater Management Alternatives

1. Wastewater Collection Systems

Three types of systems can be used for the collection of wastewater from residential and commercial customers: gravity systems, pressure systems, and vacuum systems.

The gravity sewage collection system is the most common type of collection system presently found in the United States. It consists generally of only manholes and collection lines. Exceptions to this are where gravity sewers are prohibitive physically, economically or ecologically; under these circumstances pump stations are employed. The gravity system depends on gravity to transport wastewater from one location to another. Pipes must be laid in trenches with a continuous slope sufficient to maintain flow velocity at 2 to 5 feet per second, in order to avoid settling of solids on the pipe bottom. Pipes may be cast iron, clay, concrete, or asbestos cement and range in size from 8 inches to greater than 12 feet in diameter.

Advantages and disadvantages associated with gravity collection systems are as follows:

Advantages:

- Pumping may not be necessary
- Low operation and maintenance (O&M) costs

Disadvantages:

- High construction costs
- Deep excavation may be necessary
- Pump stations may be necessary in hilly or flat areas (high construction and operation/maintenance (O&M) costs)
- High infiltration and inflow (I/I).

A pressure sewer system operates in the same manner as a water distribution system. The major difference is that a water system has only one source and many outlets and a pressurized sewer has many sources and only one outlet.

Pressure systems may be used to pump wastewater from house drains or septic tanks to a treatment site, main sewer line, or a disposal field. Wastewater pumps may be installed on existing septic tanks, or they may be installed in separate, small pumping stations. Pipe sizes for pressure systems are fairly small; 1-1/4 to 6 inches in diameter is common.

Pressure sewer systems have a number of advantages and disadvantages compared to conventional gravity sewer systems.

Advantages:

- Lower collection system construction costs
- Elimination of infiltration and inflow

Disadvantages:

- Higher waste concentrations
- Presence of hydrogen sulfide odors at a wastewater treatment plant
- Higher O&M costs particularly for pumps and leak detection
- Greater use of energy.

The vacuum system, like the pressure system, does not depend upon downward sloping pipes for wastewater movement. Energy is provided by a central vacuum source which draws wastewater from a large group of individual houses. As with the pressure system, the vacuum system requires small-diameter pipes. The advantages and disadvantages of vacuum sewers are similar to those of pressure sewers.

Advantages:

- Lower collection system construction costs
- Less infiltration and inflow
- Reduced water consumption if vacuum toilets are utilized

Disadvantages:

- Component reliability - high O&M costs
- Insufficient prototypes and field testing
- Greater use of energy.

The pressure and vacuum sewer systems can be a viable alternative in small communities and areas having high groundwater, hilly terrain, or severe rocky conditions because of the shallow depths required for the collection lines. They may carry wastewater directly to a small wastewater treatment plant or they may discharge to a larger gravity system.

2. **Wastewater Treatment Systems**

Specific levels of wastewater treatment selected for use at a municipal or regional treatment plant are largely dependent upon state and federal requirements and the type of wastewater disposal alternative being considered. The levels of wastewater treatment are:

- Primary treatment
- Secondary treatment
- Advanced secondary treatment
- Advanced wastewater treatment (AWT).

The objective of primary wastewater treatment is to remove settleable and floating materials in wastewaters. This is usually accomplished by some form of settling tank following a trash rack (or bar screen) and a grit chamber. Primary treatment will typically remove 60 percent of the suspended solids and 35 percent of the five-day BOD in untreated wastewater. Primary treatment itself will not provide enough treatment to satisfy state and federal requirements. However, primary treatment is almost always the first step in a wastewater treatment plant that provides additional forms of treatment.

The objective of secondary treatment is to remove soluble materials. Most often, secondary treatment is equated with treatment processes that promote decomposition of organic matter by bacteria and other microorganisms. The combination of primary and secondary treatment normally gives 90 percent removal of both suspended solids and dissolved organic matter (technically referred to as biochemical oxygen demand - BOD). Nitrogen and phosphorus compounds are not removed in a secondary treatment plant that is operating near or above its capacity. Ninety percent removals of both suspended solids and five-day BOD are the State of Florida's minimum allowable treatment requirements.

Advanced secondary treatment has come to be defined as secondary treatment plus additional filtration and nitrification treatment processes. Filtration media usually consist of various sizes of sand which remove suspended and soluble materials such as metals and complex organic compounds. Nitrification refers to the conversion of ammonia to nitrite and nitrate. Nitrification is most effectively accomplished by certain forms of bacteria in the presence of large amounts of oxygen.

Advanced wastewater treatment (AWT) is required when stringent water quality standards are applied to the receiving waters. AWT is defined by the State of Florida as the series of treatment processes required to produce a wastewater effluent with not more than five mg/l of suspended solids, five mg/l of five-day BOD, three mg/l of total nitrogen and one mg/l of total phosphorous. In addition to secondary and advanced secondary treatment, AWT often involves processes for the removal of nitrogen, phosphorus and/or additional organic compounds not otherwise removed from wastewaters.

Nitrogen, in its many forms, plays a fundamental role in the aquatic environment. Excessive discharges of nitrogenous materials to natural waterways, however, can cause ecological imbalances in the natural environment. Advanced treatment processes for removing nitrogen include biological nitrification - denitrification, ammonia stripping, ion exchange, and breakpoint chlorination. These processes convert the nitrogen forms in wastewater to nitrogen gas which can be released to the atmosphere. As the atmosphere consists of nearly 80 percent nitrogen, no air pollution problems will result.

Excess phosphorus discharges have also been shown to be a factor in the disruption of ecological balances in water. Phosphorus removal is achieved by adding chemicals such as alum, lime, or ferric chloride which cause solids in the wastewater to coagulate or clump together to settle out faster. This process is quite flexible; many variations are possible. In addition, this process provides removal of BOD, suspended solids, heavy metals, bacteria and viruses.

Some soluble organics are resistant to biological breakdown and thus will not be removed by secondary treatment. Activated carbon will attract and accumulate these substances. Carbon adsorption is a frequently used process which utilizes these properties.

3. Wastewater Disposal Systems

a. Surface Water Discharge

The most common type of wastewater disposal is direct discharge to surface waters. Following secondary, advanced secondary, or advanced wastewater treatment, wastewater effluent is discharged to lakes, rivers, estuaries or oceans. Here, nature takes over and continues the treatment of wastewater.

The assimilative capacity of receiving waters has to be assessed before any wastewater discharges are made. The assimilative capacity is the maximum capacity a water body has for self-purification. Other factors which must be taken into account are the uses to which the waters are subjected, the desires of the people, and the total economic, recreational and aesthetic value of the receiving water system.

Discharges to estuaries and marine waters predominate in the EIS study area. An estuary is the zone where a river contacts marine waters. The water is neither completely saline nor fresh. Physical and chemical processes occurring within an estuary are more complex than those occurring in a river or stream. The rising and falling of tides in an estuary can cause significant lateral mixing in the lower reaches of a river. Also, rising tides often reverse the direction of flow in estuaries. In many estuaries, tidal action actually increases the amount of mixing and dispersion of the waste along its length. Estuarine waters are normally vertically stratified during periods of low freshwater flows. Salt water is heavier than fresh water and creates a layer system in estuaries where fresh water rests on top of the salt water.

The chemistry of saline waters is more complex and differs greatly from the chemistry of fresh waters. The presence of large amounts of sodium and chloride ions makes the electrostatic forces between positively and negatively charged particles significant. Processes such as coagulation, which takes place in a water treatment plant, have been documented in estuarine waters.

The disposal of wastewater into marine waters is normally carried out through the use of a submerged outfall which extends some distance from shore. At the end of the outfall is the diffuser section which is normally placed perpendicular to the prevailing ocean currents. However, currents are often not predominant in any one direction. In this circumstance, a Y-shaped or V-shaped diffuser is generally used.

At the end of the outfall, wastewater is released and mixes with the surrounding seawater. This mixture is called the sewage field and, being lighter than seawater, rises to the surface, drifting with the ocean currents. At the same time that the field is rising, it is diffusing outward into the surrounding waters.

The initial dilution from an efficient diffuser is so great that the reduction in dissolved oxygen at the outfall is usually insignificant. Bacterial, floatable material, nutrient and toxicity requirements will govern design and location of most outfalls. As for bacterial numbers, 90 percent decay rate can usually be obtained in two to six hours after release to marine waters. This variation in time is dependent upon temperature, salinity and pH.

Movement of marine waters is dictated by predominating currents and wind-wave action. The chemistry of marine waters is dominated by the presence of sodium and chloride ions as discussed previously for estuaries.

b. Wetlands Discharge

The term wetlands is a broad classification covering areas known as marshes, bogs, wet meadows, peatlands, and swamps. They generally consist of low-lying, usually level, saturated land, partially or intermittently covered with standing water. In wetland discharge systems, wastewater is renovated by the soil, plants, and microorganisms as it moves through the soil profile. However, renovation action is usually more dependent on microbial and plant activity than on soil chemistry.

Two categories of wetlands are available for municipal wastewater disposal in the study area: (1) artificial wetlands and (2) existing wetlands. Artificial wetlands may consist of a combination of wetland meadows, marshes, or swamps, some of which may be man-made to treat wastewater in association with the underlying soil profile. Existing wetlands, often composed of hydrologically intermediate areas with plants adapted to periodic inundation by water, are an emerging opportunity in wastewater management. Managed wetlands, utilizing cypress domes, water hyacinths or other nutrient removing crops, can facilitate high levels of wastewater treatment.

The expected quality of renovated wastewater that can be achieved from disposal to an artificial wetland is presented below:

BOD = 7.0 mg/l
Suspended Solids = 6.0 mg/l
Total Nitrogen as N = 1.1 mg/l
Total Phosphorous as P = 3.8 mg/l

These values represent secondary effluent discharged to lagoons planted with water hyacinths. (Process Design Manual for Land Treatment of Municipal Wastewater, U.S. EPA, October 1977).

c. Well Injection

Wastewater can be added to the water table or to deep geological formations as a method of wastewater disposal. Most often, use of this disposal method involves forced injection of wastewaters into subsurface areas. To determine the feasibility of an injection facility, the following factors must be considered:

- o Water table or aquifer characteristics such as size, water pressures, permeability, clogging potential, water quality and movement of ground- water in all direction
- o Amount of wastewater that can be injected continuously into an injection well
- o Proximity of water supply formations
- o Degree of wastewater treatment required prior to injection
- o Energy costs and the proportion of energy costs to total costs
- o Other disposal costs and environmental impacts.

The feasibilty of injecting wastewaters into wells is highly dependent on local geological characteristics.

Shallow-well injection appears to be more attractive in coastal areas where the underlying water table and aquifer have experienced salinity intrusion rather than in areas that have not experienced salinity intrusion. Conceivably, any wastewater injected into the low chloride water table could be reused for lawn irrigation or other non-potable water usages. However, because most of the wells in the EIS study area draw water from the relatively shallow sandand-gravel aquifer, public and private water supplies could become contaminated as a result of shallow-well injection.

Deep-well injection has received favorable review within Florida, because it removes the potential for surface water pollution. Its use is considered to be in the experimental stage. In addition, concerns about the effects of wastewater injected into deep-wells in the Floridian Aquifer are evident, particularly if wastewater is injected into non-saline geologic formations. Despite these concerns, deep-well injection is being used at the present time for industrial wastes just north of the EIS study area. Monsanto, for example, discharges to a non-potable portion of the Lower Florida Aquifer at a well depth of 1400 feet.

The Florida DER has established an Underground Injection Program to investigate the feasibility of deep-well injection and to supervise its operation in Florida. Conversations with this group have revealed that for deep-well injection to be considered, DER requires that two basic criteria be met:

1. A saline formation must be identified that has a concentration of dissolved solids greater than 10,000 mg/l. Preferably two confining geological layers should be present between this saline zone and a freshwater zone.

2. Reasonable transmissivities (rate of flow into aquifer) must be available.

d. Land Application

Pre-treated wastewater can be applied to the land in order to provide further treatment or to eliminate a direct discharge of effluent to surface waters. Treatment is provided by natural processes as the applied wastewater moves through the natural filter provided by the soil, plants, and related ecosystem. Part of the wastewater is lost by evapotranspiration, while the remainder returns to the hydrologic cycle through runoff or via the groundwater system.

The three principal types of land application of wastewater are slow rate irrigation, rapid infiltration, and overland flow. All three methods require the prior treatment of wastewater to levels adequate to protect public health, preclude odor problems, and prevent clogging of soils or the distribution system due to excessive solids. A level of secondary treatment is sufficient for these purposes. Each technique has its advantages and disadvantages; selection of the most suitable technique for a given area is dependent upon site-specific conditions and objectives. Tables II-4, II-5 and II-6 provide a summary of the expected quality of the renovated wastewater for these techniques, a comparison of the typical design features and major site characteristics.

Slow rate irrigation is the predominant land application technique in use today. It involves the application of pre-treated wastewater onto the land either by sprinkler or by surface flooding in order to support plant growth. The wastewater is "lost" to plant uptake, to the air by evapotranspiration, and to the groundwater by percolation. Wastewater which percolates through the soil matrix is renovated by physical, chemical, and biological processes. A well-drained soil is preferred. In general, soils ranging from clays to sandy loams are suitable.

Slow rate irrigation is generally capable of producing the best results of the land treatment systems. Organics are substantially reduced by biological oxidation within the top few inches of the soil. Suspended solids and fecal coliform are filtered as the wastewater passes through the soil matrix. Nitrogen is primarily removed by vegetative uptake; phosphorous is removed from solution by fixation processes in the soil and by vegetative uptake.

In rapid infiltration systems, pre-treated wastewater is applied to the land at high rates (4 to 84 inches per week) by flooding in surface basins or high-rate sprinkling. Renovation of the applied wastewater occurs as it passes through the soil matrix. The renovated wastewater can be used for (1) groundwater recharge, (2) natural treatment followed by recovery of the percolated wastewater through pumped withdrawal or collection by underdrains, (3) natural treatment with renovated waters moving vertically and laterally through the soil and recharging nearby surface waters, or (4) temporary storage in the aquifer. Subsoil and aquifer characteristics must be known in order to control the wastewater after it infiltrates the surface and percolates through the soil matrix. Recharge should not be attempted without specific knowledge of the movement of the water in the soil system and the groundwater aquifer.

Overland flow involves the application of pre-treated wastewater over the upper reaches of sloped terraces. The applied wastewater is allowed to flow across the vegetative surface to runoff collection ditches. As the wastewater flows down the slope in a thin sheet, it is renovated by physical, chemical, and biological processes. The collected wastewater may either be discharged to surface waters or recycled back to the land.

Table II-4. Expected Quality of Treated Water from Land Treatment Processes[a] (mg/l unless otherwise noted)

Constituent	Slow rate[b]		Rapid Infiltration[c]		Overland flow[d]	
	Average	Upper Range	Average	Upper Range	Average	Upper Range
BOD	<2	<5	5	<10	10	<15
Suspended solids	<1	<5	2	<5	10	<20
Ammonia nitrogen as N	<0.5	<2	0.5	<2	<4	<8
Total nitrogen as N	3[e]	<8[e]	10	<20	5[f]	<10[f]
Total phosphorus as P	<0.1	<0.3	1	<5	4	<6
Fecal coliforms, No./100 ml	0	<10	10	<200	200	<2,000

a. Quality expected with loading rates at the mid to low end of the range shown in Table II-5.

b. Percolation of primary or secondary effluent through 1.5 m (5 ft.) of unsaturated soil.

c. Percolation of primary or secondary effluent through 4.5 m (15 ft.) of unsaturated soil; phosphorus and fecal coliform removals increase with distance.

d. Treating comminuted, screened wastewater using a slope length of 30-36 m (100-120 ft.).

e. Concentration depends on loading rate and crop.

f. Higher values expected when operating through a moderately cold winter or when using secondary effluent at high rates.

Source: Process Design Manual for Land Treatment of Municipal Wastewater, USEPA, October 1977.

4. Sludge Treatment and Disposal Systems

Sludge is composed of any floatable or settleable materials collected in the sedimentation processes at wastewater treatment plants. Satisfactory treatment and disposal of sludges can be technologically complex and costly. Six different types of sludge processing are available. They include concentration, digestion, conditioning, dewatering and drying, incineration and wet oxidation, and disposal. Table II-7 contains a description of each type of process along with a list of commonly used processes within that category.

An important consideration in the analysis of sludge treatment and disposal methods in the EIS study area will be the availability and capacity of existing facilities. The Main Street incinerator, for example, is currently slated to handle processed sludges from other treatment plants in Escambia County.

Table II-5. Comparison of Design Features for Land Treatment Processes

Feature	Principal Processes		
	Slow Rate	Rapid Infiltration	Overland Flow
Application Techniques	Sprinkler or surface[a]	Usually surface	Sprinkler or surface
Annual application rate, m	0.5-6	6-125	3-20
Field area required, ha[b]	23-280	3-23	6.5-44
Typical weekly loading rate, cm	1.3-10	10-240	6-40[c]
Minimum preapplication treatment provided in the United States	Primary sedimentation[d]	Primary sedimentation[e]	Grit removal and comminution[e]
Disposition of applied wastewater	Evapotranspiration and percolation	Mainly percolated percolation	Surface runoff and evapotranspiration with some percolation
Need for vegetation	Required	Optional	Required

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a. Includes ridge-and-furrow and border strip.
b. Field area in hectares not including buffer area, roads, or ditches for 3,785 m^3/d (1 Mgal/d) flow.
c. Range includes raw wastewater to secondary effluent, higher rates for higher level of preapplication treatment
d. With restricted public access; crops not for direct human consumption.

e. With restricted public access.

Source: Process Design Manual for Land Treatment of Municipal Wastewater, U.S. Environmental Protection Agency, October, 1977.

Table II-6. Comparison of Site Characteristics For Land Treatment Processes

Feature	Principal Processes		
	Slow Rate	Rapid Infiltration	Overland Flow
Grade	Less than 20% on cultivated land; less than 40% on noncultivated land	Not critical; excessive grades require much earthwork	Finish slopes 2-8%[a]
Soil permeability	Moderately slow to Moderately rapid	Rapid (sands, sandy loams)	Slow (clays, silts, and soils with impermeable barriers)
Depth to ground water	0.6-1 m (minimum)[b]	1 m during flood cycle[b] 1.5-3 m during drying cycle	Not critical[c]
Climatic restrictions	Storage often needed for cold weather and during heavy precipitation	None (possibly modify operation in cold weather)	Storage usually needed for cold weather

a. Steeper grades might be feasible at reduced hydraulic loadings.

b. Underdrains can be used to maintain this level at sites with high ground water table.

c. Impact on groundwater should be considered for more permeable soils.

Source: Process Design Manual for Land Treatment of Municipal Wastewater, U.S. Environmental Protection Agency, October, 1977.

Table II-7. Types of Sludge Processing

Type	Description	Names of Processes
Concentration	Separating water and sludge to reduce sludge volume	Air flotation or thickening Gravity thickening
Digestion	Processes that reduce odors, numbers of pathogens and sludge volume	Aerobic digestion Anaerobic digestion Sludge lagoons
Conditioning	Preparing a sludge for dewatering processes	Chemical addition Elutriation Freezing (experimental) Heat treatment
Dewatering and drying	Separating water and sludge to reduce sludge volume	Centrifugation Drying beds Pressure filtration Vacuum filtration on belt filter press Vibration
Incineration and wet oxidation	Reducing organic content and volume of sludge at elevated temperatures	Incineration Wet oxidation
Sludge disposal	Permanent transfer of sludge to land or water	Dumping Fertilizer, soil conditioner or composting Lagoons Landfill Spreading of liquid sludge to soil, stream, lake or coastal waters

Source: Gannett Fleming Corddry and Carpenter, Inc., 1981.

5. On-Site and Small Community Systems

Projected low development densities and environmental limitations will preclude the installation of sewers in many areas within the study area. In addition, certain areas may be effectively served with alternative on-site systems and package plants without the need for expensive capital improvements or treatment plant construction. Therefore, it is important to consider septic tanks and package plants as viable alternatives in certain locations.

An analysis of soils in the study area indicates several areas where on-site soil absorption systems are feasible. Package plants serving higher density areas and disposing of effluent via subsurface or surface land disposal, or surface water discharge may also be considered feasible in certain areas. These alternatives are discussed in the following sections.

a. On-Site Systems

On-site wastewater management systems if properly installed and maintained, can be effective options to centralized systems. Soil type and depth to groundwater are the most important determinants. Several types of on-site systems exist and their use depends on soil type, slope and other hydrologic or geomorphologic characteristics. Some systems such as mounds can be used in areas typically considered unacceptable for conventional on-site systems, such as areas characterized by impermeable soils.

Two different soils characteristics can limit the use of on-site systems. If soils are relatively impermeable, the effluent is not able to flow properly through the drainfield leading to system failure through backing up in the system or ponding on the surface. In either case, the effluent does not achieve the degree of treatment desired. Soils that are extremely permeable, such as sand with little clay or silt, also do not provide a sufficient degree of treatment under some conditions. Water quality concerns associated with highly permeable soils are usually addressed by set-backs from surface waters and the degree of allowable development density. Public health concerns under such conditions are important primarily where private wells used for potable water are proximal. Under other conditions, the potential concerns associated with highly permeable soils are not as important.

In either case presented, water quality or public health problems can be prevented if proper management techniques are followed. These techniques include siting, selection of the best system for the given conditions, proper installation, and periodic maintenance. If these procedures are followed, on-site systems can be effectively utilized in most areas. On Perdido Key and Santa Rosa Island some private wells are still used for drinking water. As development occurs near these wells, however, the Northwest Florida Water Management District policy requires property owners to connect to the public water supply. This practice should prevent potential public health problems associated with on-site or small community systems.

Little documentation of any adverse effects of on-site and small community systems in the area has been compiled. Reports from authorities representing the City of Gulf Breeze have indicated that septic tanks are suspected to cause local flooding during periods of intense rainfall. At these times the potential for public health problems increases as septic tank effluent flows to the surface. This problem, however, has not been documented by water quality data collected during such conditions.

The capital expenditures associated with septic tanks and other on-site systems are considerably lower than centralized systems. For a barrier island which is exposed to storms and potential flooding, on-site systems may be an optimal solution to centralized systems since storm damage to a central facility and its interceptors would not only interrupt service drastically but would also require large repair or replacement costs. If properly constructed and monitored, on-site systems have lower capital expenditures and result in diffused rather than point sources of effluent. Properly constructed systems would provide renovation of effluent in the soil profile prior to discharging to surface waters. Further, groundwater quality would not be detrimentally impacted if densities, construction, and inspections were adequate.

Generally, in order to achieve satisfactory renovation of wastewater effluent, deep, permeable and fine texture soils are required. Soils of this nature exist in many of those areas in Escambia County where low density residential development is anticipated. The region in the vicinity of Saufley Field has large parcels of deep, well-drained, moderately permeable Norfolk and Lakeland loamy sand that have only minor limitations regarding their use for on-site soil absorption systems. Conventional soil absorption systems have a high potential for use in these areas, even after consideration of local subsurface disposal regulations. Where soils are found only moderately permeable, the size of the drainfield could be increased accordingly to avoid hydraulical overloading.

Several areas in Southwest Escambia County that are still undeveloped also appear to have a high potential for soil absorption system use. Many areas along Gulf Beach Highway consist of Lakeland fine sands that have essentially no limitations for soil absorption systems except for rapid permeability, whereby a small amount of fine textured fill may be utilized to lower the percolation rates. Many private residences on Perdido Key use on-site systems without any reported evidence of problems.

The Gulf Breeze Peninsula is also suited in many areas for soil absorption systems as indicated by the general soils map (see Appendix C) which shows large patterns of the moderately well-drained and excessively-drained Ortega and Kureb soils on the Peninsula. Proper design of an on-site system should easily overcome potential problems of a fluctuating water table in the Ortego series. In summary, much of the high and undeveloped area along U.S. Highway 98 on the Gulf Breeze Peninsula has a high potential for the use of on-site treatment and disposal systems.

b. Small Community Systems

Some areas in South Escambia and Santa Rosa Counties are potentially ideal locations for package treatment plant systems coupled with either a land surface or subsurface disposal technique. Package treatment units capable of treating flows from 500 to as much as 200,000 gallons per day are available from commercial sources. These units can produce a quality effluent which can be additionally treated and disposed of by subsurface sand filters or chlorinated and discharged to surface waters.

Package treatment plants are a potential treatment alternative for environmentally sensitive areas, more densely populated rural areas or as a corrective measure for alleviating problems stemming from improper performance of individual on-site systems. This alternative is best suited for those areas with deep, well-drained and developed soils. Where these conditions do not naturally occur, the site could be modified and an absorption system constructed above ground in a mound configuration. Small community systems are currently used on Santa Rosa Island, Gulf Breeze Peninsula and in Southwest Escambia County, including Perdido Key.

As previously indicated, limited data have been collected on the impacts of on-site and small community systems on groundwater quality. Further, little is documented about near-surface groundwater movement in coastal areas of Escambia and Santa Rosa Counties. This was recognized early in the EIS and emphasis was placed on collecting such data. This data collection activity, however, was outside the scope of the EIS. The West Florida Regional Planning Council has also been interested in documenting the influence of on-site and small community wastewater systems on groundwater quality. As a result, a study was undertaken during 1983 to assess the small-community wastewater systems on Perdido Key. This study was conducted by the Northwest Florida Water Management District (NWFWMD) for the West Florida Regional Planning Council as part of the 208 Continuing Planning Program. This assessment is the best information available in the study area to assess the influences of small community systems on groundwater and adjacent surface waters. The following discussion is taken from the conclusions of the study report.

> The discharge of package sewage treatment plant effluent by means of percolation ponds and drainfields was investigated in an effort to establish minimum setback distances from coastal surface water bodies. Specifically, the investigation was concerned with defining: 1) the principal receiving body for package sewer treatment plant (PSTP) effluent; 2) the distribution of plants within the project area and the pertinent physical parameters for each plant including soil type, effluent discharge rate and proximity to surface water; 3) establishing minimum setback distances from surface water bodies; and 4) establishing minimum spacings between facilities to prevent hydraulic interference and overlapping of contaminant plumes. Below is a brief summary of the investigation:
>
> 1. In southern Okaloosa, Santa Rosa and Escambia Counties, the surficial zone of the sand-and-gravel aquifer is the primary receiving body for package plant effluent. The effluent discharge does not impact the lower main producing zone of the sand-and-gravel aquifer significantly owing to the presence of low permeability confining beds below the surficial zone.

2. Current regulations recommend minimum surface water setback distances and maximum water-table elevations for discharge facilities. In many instances, particularly Perdido Key, these recommendations have not been followed.

3. Eighteen of the 22 active or proposed facilities are in southern Escambia County. Thirteen facilities are on Perdido Key, a coastal barrier island bounded by Old River sound and the Gulf of Mexico. At least four additional facilities are proposed for Perdido Key.

4. Water quality data from facility monitoring wells indicate that contaminants from the discharge facilities are entering the groundwater. Nitrate nitrogen ranges from 0.51 to 10.53 mg/l with a mean value of 3.36 mg/l at facilities for which data was available.

5. To determine the effects of PSTP discharge on the surficial zone of the sand-and-gravel aquifer, a digital computer model was used to simulate changes in groundwater flow and the migration of contaminants. A fine grid model was used to examine in detail the flow and mass transfer characteristics in the immediate vicinity of a single facility and a coarse grid model to examine the composite effects of several facilities. Because rainfall recharge attenuates the contaminant plume by dilution, two different recharge conditions were simulated. These included long-term normal recharge and a short-term low recharge condition.

6. As expected, the shoreline concentration of contaminants is sensitive to the facility discharge rate and the setback distance. On the basis of the computer model simulations, appropriate setback distances were identified for a practical range of discharge rates that would reduce the shoreline nutrient concentrations to less than 1 mg/l. At higher discharge rates, the minimum setback distance cannot be realized on Perdido Key because of the limited width of the land mass. In these areas, the only feasible means of reducing the facility impacts on surface water is to limit the effluent discharge rate for future facilities.

7. The mounding effect in the vicinity of the discharge facilities has been shown to be on the order of two to four feet at discharge rates of from 0.024 to 0.058 Mgal/d. The minimal mounding is attributable to the high permeability of the soils and their

characteristically rapid drainage rate.

8. Under low rainfall recharge conditions, shoreline concentrations tend to increase as a result of decreased dilution. Further increasing the setback distances will aid in alleviating this problem.

9. On Perdido Key, some overlapping of contaminant plumes from individual facilities has occurred. With an increasing number of facilities, consideration should be given to establishing a minimum spacing between facilities. As with the surface water setback line, recommended spacings have been listed based on the facility discharge.

For this study, a nutrient value of 1 mg/l was arbitrarily chosen to assess the impacts of percolation pond discharges on nearby surface waters. The value is not meant to indicate that 1 mg/l of nitrogen or phosphorus will or will not cause water quality problems but is a benchmark for comparative purposes. The study should prove valuable to the regulatory agencies responsible for wastewater management.

Tables II-8 and II-9 describe various on-site and small community systems and list their general advantages and disadvantages.

6. Nonstructural Controls

Effective and functional nonstructural control mechanisms for wastewater management can be an important adjunct to the structural collection and treatment facilities. Nonstructural considerations include a variety of regulatory, administrative, and educational procedures that can be used to supplement structural water quality control techniques. While the application of nonstructural methods may provide a means of lessening the magnitude of structural facilities required for attainment and maintenance of water quality standards, the construction of wastewater treatment plants or individual on-site systems remains a major technique for effectively controlling water pollution. Therefore, the principal focus of nonstructural alternatives is their use in supporting and supplementing structural alternatives and solutions.

a. Water Conservation

The benefits of water conservation and flow reduction techniques can include reducing treatment operating costs, relieving overloaded wastewater treatment and collection facilities, reducing the capacity required for new facilities or eliminating the need for expansion of existing facilities.

Several nonstructural measures are available and can be used within the study area for reducing water use and wastewater flow. They include:

- Plumbing code implementation and enforcement
- Educational programs
- Water and wastewater pricing.

Table II-8. Descriptions of On-Site and Small Community Systems.

System	Description
Septic Tank	An enclosed sedimentation tank through which untreated sewage flows slow enough to permit settling of solids. Sludge and scum are reduced in volume and volatility as they sit in the bottom of the tank.
Filter	A surface of sand usually 24 to 30 inches thick. Pretreated wastewater is applied intermittently and collected by drains at the bottom of the filter. Rates of wastewater application can vary between 1 and 15 gallons per day per square foot. Some filter systems incorporate recircitation of wastewater. Rocks or other large solid particles can be used also.
Extended Aeration	A biological treatment system utilizing high microorganism concentrations. Oxygen is supplied by aeration. Settling of solids follows aeration. Portions of the settled solids are recycled to the treatment unit.
Lagoon	Ponds that are constructed to receive wastewater and allow biochemical wastewater treatment. Lagoon systems normally consist of four or more ponds in series. Lagoons can be mechanically aerated.
Rotating Biodisk	Settled wastewater is contacted with a rotating disk that has a biological film. Adsorption and bacterial action result in treatment of wastewater.
	Disposal Systems
Soil Absorption	Shallow excavated areas partially filled with coarse rock. Perforated piping is placed over the rock to distribute the wastewater. These systems are usually entirely buried. Loading rates depend upon soil characteristics. Ultimate discharge is to the groundwater table. Two or more absorption fields can be operated in turn. A pump can be used to apply the wastewater evenly across the field.
Sand Mound	Elevated sand mound provided to treat wastewater in areas where soil absorption systems are unsuitable. Wastewater is dosed onto the mound by a pump or siphon. Ultimate discharge is to the groundwater table.
Irrigation	Soil is irrigated via spraying, ponding or overland flow. Ultimate disposal is to the groundwater table or receiving stream. These systems are analagous to systems used at large treatment plants.
Lagoon	One or more ponds constructed to receive wastewater. Ultimate disposal is via evaporation and transpiration by plants or to the groundwater table.
Evapotranspiration Bed	Lined or unlined excavation partially filled with rock, distribution piping and sand. Pretreated wastewater is discharged and is forced to the ground surface. Evaporation and plant transpiration take place at or near the soil surface. Lined excavations are used in areas where groundwater and surface water contaminatoin are concerns.

Table II-9. Advantages and Disadvantages of Various On-Site and Small Community Systems.

Treatment Systems

System	Approximate Cost (1977 dollars)	Operation and Maintenance	Energy Use	Reliability/ Implementability
Septic Tank	$600 per home plus $40-$60 each time septage is pumped	Inspection and pumping every 1 to 8 years	None	Very reliable particularly with periodic inspection and maintenance. Approx. 50 percent removal of 5-day BOD. Commonly used throughout the U.S. and Florida. Disposal of septage is important.
Filter	$5 to $15/sq. ft. of surface area plus $1/sq. ft./yr.	Pump or siphon may be needed to dose filter or recycle effluent. Top 2 to 4 inches of sand require periodic replacement. Filter may need to be rested occasionally.	Low, possibly for pumping.	Pretreatment is usually provided by septic tanks. Effluent usually has less than 10 mg/l of 5-day BOD and SS. Filter sizes limit use to on-site and small community locations because of land and labor requirements. High seasonal groundwater table can be a problem.
Extended Aeration	$1,500 to $2,500/ 1,000 gal. for household unit, plus $60-$120/yr. for labor, plus power costs (5-10 KWH/day).	Semi-skilled person needed for frequent inspection and operation	High, aeration and pumping	715 to 90 percent removal of 5-day suspended solids and pathogens. Poor maintenance can cause odors. Disposal of sludge is important.
Lagoon	$0.30 to $0.50/1,000 gallons of wastewater treated per year.	Variable depending on whether effluent is recirculated, chemicals are added, plants are harvested, or ecological communities within a pond are controlled.	Possibly for pumping wastewater to the pond or if ponds ponds are aerated.	Greater than 90 percent removal of 5-day BOD and suspended solids is possible but unlikely. Land requirements and potential odors are limitations to usage. For treatment, lagoons are sensitive to climate conditions.
Rotating Biodisk	Not given	Little maintenance requirements	Low power	Susceptible to climate and damage unless housed.
		Disposal Systems		
Soil Absorption	$1.15 to $1.50/sq. ft. for construction. $600 per home for only pump and tank, if pump is used.	Little. Periodic resting of system prolongs life. Pump maintenance is needed if pump is used.	Low. Pumping may be used to spread effluent evenly onto absorption field and improve performance.	Restricted to areas with deep and moderately to well-drained soils. Use during wet season is further restricted. Additional treatment takes place as effluent percolates through the soil.

Table II-9. Continued.

Treatment Systems

System	Approximate Cost (1977 dollars)	Operation and Maintenance	Energy Use	Reliability/ Implementability
Sand Mound	$0.75 to $3.00/sq. ft. of basal area for construction of mound and pumping chamber. Approx. cost is $2,000/home installation.	Pump or siphon maintenance and periodic replacement of top two to four inches of sand.	Moderate if pump is used.	Use is not as restricted as use of soil absorption systems. Additional treatment takes place. Principal application has been for single homes and businesses. Size of a system is only limited by site conditions.
Irrigation	Costs per unit volume of treated effluent are higher than for larger, municipal flows.	Variable depending on type of irrigation system.	Variable depending on type of irrigation system.	Restricted to areas with deep and moderately to well-drained soils. Use during wet season is further restricted. Additional treatment takes place as effluent percolates. Irrigation systems are used by small communities more than individual residences.
Lagoons	$0.30 to $0.50/1,000 gallons of wastewater disposed.	Variable	Possible for pumping wastewater to the pond.	Land requirements are the biggest limitation. Odors and pests can be a problem particularly if wastewater is not pretreated.
Evapotranspiration Bed	$1.00 to $1.50/sq. ft. of bed area for construction.	Periodic removal of bed deposits	Possibly for pumping wastewater to the bed.	Particularly suitable in areas where soil percolation is unsuitable and evapotranspiration rates are high. Size of a system is limited only by site conditions. Less suitable during rainy months.

Flow reduction techniques, as listed above, can be expected to have the greatest impact on growth areas due to the ease with which these measures can be implemented in new construction.

Plumbing codes can be the most effective regulatory means of implementing the use of flow reduction plumbing fixtures in all future developments and wherever replacement fixtures are needed. The following are examples of amendments to plumbing codes that might be considered for flow reduction purposes.

- Tank-type toilets to be of a design that provides a maximum flush not to exceed 3 1/2 gallons. This would reduce water flow from toilets by 30 to 50 percent.
- Water-saving shower heads to limit flow to a maximum of three and one half gallons a minute. Presently, most showers have flow rates of six gallons per minute.
- Water-saving faucets to limit flow to a maximum of three gallons a minute with self-closing devices on faucets at commercial or industrial establishments.
- Installation of pressure-reducing valves on the incoming service to all structures for all properties when the incoming water pressure is expected to exceed 60 pounds per square inch (psi). This valve should provide adjustment of the pressure for the household service to within the range of 50 to 60 psi.
- Floor drains should not be connected to the sanitary sewer system. When floor drains are installed, they must be discharged to an approved storm drain. All buildings erected with cellars or basements in areas known to have a water table above the basement floor would be required to have foundation drains around the outside of the building with a satisfactory point of discharge other than to the sanitary sewer system.

Citizen education programs, if pursued aggressively, can have a beneficial effect and can be approached in two stages. Public advertising alerts the citizens to the issue. Water companies and/or municipalities can then provide low cost water conservation kits to interested citizenry. Easy-to-install flow reduction devices for shower heads and toilet tanks are presently available to water customers at low cost in a number of communities throughout the United States.

A water and wastewater pricing technique that may be effective is increasing block rates. Under this technique, water charges are kept at a uniform rate per gallon until consumption reaches a certain level, when a higher price rate is specified for consumption within the next level or block and so on. Water use must be metered in order for an increasing block rate structure to be usable.

The effective implementation of water conservation in the study area during the planning period is uncertain. In an area where water supplies appear to be abundant and where water rates are not excessive, the motivation for conservation is not great. Plumbing codes for new construction would appear to be the most promising technique.

Based on the uncertainties of success of water conservation, it has been assumed that there would likely be no more than a 10 percent overall average reduction in commercial and residential flows in the year 2000 under this non-structural alternative. Because of the non-removable infiltration/inflow, 5 percent and 10 percent reductions in consumption would only result in approximately a 3.7 and 7.2 percent reduction, respectively, in total planning area wastewater flow. This would not have any effect on pipe diameters. Treatment plant sizes would not be measurably decreased, since about 90 percent of the planning area flows will likely be treated at existing plants, and various peak flow producing conditions could largely offset the effects of conservation. As a result of year-round conditions, however, operating costs would be reduced to reflect reduced flows.

b. Land Use and Development Controls

The EIS study area is a sensitive, coastal region. As the population increases, there will be pressure to convert currently undeveloped land to an assortment of uses such as residential, commercial, recreational, industrial, and streets and highways. This development would generate increased storm runoff, which may significantly degrade surface water quality depending on the type and location of development. In addition, wastewater generated by this new development must be assimilated by a limited land and water system.

Development controls are used to influence the type, pattern, and overall density of development. They can also be used to limit or prohibit development in areas which have been determined as unsuitable, such as floodplains and wetlands. When coupled with a formal capital improvements plan, development controls can be used to guide development to areas which can be efficiently served by public utilities, thus avoiding untimely and costly utilities expansion and potential environmental problems.

A large portion of the study area is located in jurisdictions which have adopted zoning ordinances and other specific development controls. Pensacola, the Santa Rosa Island Authority, and Gulf Breeze have adopted extensive land use regulations and development controls. Escambia County and Santa Rosa County have also adopted limited controls applicable in certain areas. In addition, the state has enacted several regulatory programs concerning construction in the coastal area. However, it should be noted that the two areas in the Escarosa study area with the greatest development potential, Southwest Escambia County and the Gulf Breeze Peninsula, are not covered under any zoning ordinance and are minimally affected by other development controls. A zoning ordinance was adopted in July 1983 for Perdido Key and is discussed in greater detail in Chapter III.

Environmentally sensitive areas such as floodplains and wetlands could be avoided by zoning for low density residential use (minimum lot size: 5 acres) or agricultural use. Considering the availability of public utilities, environmentally compatible areas could be zoned at higher densities in order to make sewer extensions or package plants economically feasible. In addition, areas suitable for on-site disposal systems could be zoned for appropriate densities in order to utilize this wastewater treatment alternative and avoid uneconomical sewer extensions. Prepared in a comprehensive manner, zoning in Escambia and Santa Rosa Counties could optimize the use of existing wastewater treatment facilities and the natural assimilative capacity of certain areas while protecting environmentally sensitive areas.

Alternative development techniques can also be encouraged through local ordinances to permit development patterns that are more responsive to environmental considerations. Cluster development and planned unit development are two alternative development techniques that provide the flexibility necessary to vary project density and protect environmentally sensitive land. Modification of existing zoning ordinances and subdivision regulations or the adoption of specific ordinances may be necessary to institute these alternative development techniques. In the case of Escambia and Santa Rosa Counties, new zoning ordinances can be prepared giving consideration to cluster development and planned unit development.

With alternative development techniques, the entire development site (usually several acres or more) is viewed as a complete unit, rather than on a lot-by-lot basis. Overall project density may be established through zoning; however, the developer is given the flexibility to cluster the homes or mix a variety of uses and preserve other areas of the site as common, open space. Depending on the specific content of the ordinance, the local governing authority may retain the right to designate unbuildable areas prior to development. In this way, the developer is given a specific set of constraints prior to development (overall project density and unbuildable areas) and the flexibility to adjust the site plan accordingly.

Alternative development patterns also directly affect the feasibility of certain wastewater management techniques. The higher densities allowable through clustering can be more efficiently served by centralized collection and treatment facilities than can traditional single-family subdivisions. In addition, by clustering development, developers can set aside land for a community package plant or septic tank system without having to lower the total number of housing units.

D. Wastewater Management Alternatives

Wastewater management alternatives have been developed for South Escambia and Santa Rosa Counties based on existing collection, treatment and disposal facilities and projected needs. These alternatives involve varying levels of treatment and disposal options, generally less regional in scope than the 201 Facilities Plan. Alternatives were developed separately for Escambia County and Santa Rosa County due to the geographical and institutional barriers to combined alternatives.

1. Pensacola/Escambia County

Four regional concepts for wastewater management were developed and evaluated for Pensacola/Escambia County, including the 201 Facilities Plan recommendations. In addition, a local alternative with no expansion and a No Federal Action scenario were developed and evaluated. These alternatives are described in greater detail below.

a. 201 Facilities Plan

The 201 Facilities Plan proposes the use of three wastewater treatment facilities for the area:

1. The existing Main Street plant would serve the Pensacola franchise area. It would discharge AWT level effluent to Pensacola Bay.
2. The existing Scenic Hills plant would serve the Scenic Hills area. Secondary level effluent would be disposed of by land application.
3. A new, phased construction 11.3 mgd southwest plant, with secondary level effluent disposed by a Gulf outfall, would receive wastewater flow from all of southwestern Escambia County, Perdido Key, and the present service areas of Avondale, Pen Haven and Warrington. The existing facilities of the latter three communities would be gradually phased out.

b. Regional Alternative I

The Main Street facility presently has the capacity to treat 20 mgd at an AWT level. With a decrease in treatment level, the capacity of the facility could be increased. Alternatively, with acquisition of adjacent land, the facility could be expanded and continue treatment at an AWT level. Two facilities are proposed under Regional Alternative I. These are:

1. Main Street facility expanded to serve Pensacola and all areas except Scenic Hills with treatment/disposal options of
   - Advanced wastewater treatment and discharge to Pensacola Bay
   - Advanced secondary treatment and discharge to Pensacola Bay
   - Secondary treatment with discharge by Gulf outfall
2. Scenic Hills facility continuing to operate at secondary level of treatment with disposal by land application.

c. Regional Alternative II

A variation of Regional Alternative I, this alternative will evaluate the use of existing smaller treatment plants to treat the volume of wastewater which cannot be handled at the Main Street plant without expansion. Priority for use of existing facilities in this scheme will be established on the basis of the following criteria:

- Physical condition of the facility
- Quality of effluent in context of the environmental impact on the receiving stream
- Proximity to service area needs
- Capacity.

Three facilities are proposed under Regional Alternative II. These are:

1. Main Street facility operating at capacity to serve all areas except Scenic Hills with treatment/disposal options of
   - Advanced wastewater treatment and discharge to Pensacola Bay
   - Advanced secondary treatment and discharge to Pensacola Bay
   - Secondary treatment with discharge by Gulf outfall

2. Scenic Hills facility continuing to operate at secondary level of treatment with disposal by land application
3. Avondale facility expanded to serve the remaining areas not served by Main Street facility with treatment/disposal options of
   - Secondary treatment with disposal by land application
   - Advanced secondary treatment with surface water discharge
   - Advanced secondary treatment with deep-well injection.

d. Regional Alternative III

This alternative is similar to Alternative I and II. It includes, however, a subregional treatment and disposal facility to serve Southwest Escambia County and Perdido Key rather than conveyance facilities to the Main Street facility for these areas. Thus the cost effectiveness of treatment and disposal for the southwest area versus conveyance to the Main Street facility is evaluated.

Three facilities are proposed under Regional Alternative III. These are:

1. Main Street facility expanded to serve Pensacola and all areas except Scenic Hills and southwest with treatment/disposal options of
   - Advanced wastewater treatment and discharge to Pensacola Bay
   - Advanced secondary treatment and discharge to Pensacola Bay
   - Secondary treatment with discharge by Gulf outfall

2. Scenic Hills facility continuing to operate at secondary level of treatment with disposal by land application

3. New southwest facility built to serve Southwest Escambia County with treatment/disposal options of
   - Secondary treatment with disposal by land application
   - Advanced secondary treatment with discharge to Perdido Bay
   - Advanced secondary treatment with discharge by deep-well injection.

e. Local Alternative with No Expansion

Under this alternative the existing treatment facilities would not be expanded and would resemble various elements of Regional Alternatives I or II.

Four facilities are proposed under the Local Alternative. These are:

1. Main Street facility operating to capacity (20 mgd) to serve the Pensacola franchise area and receive surplus flows from other areas in the county, with treatment/disposal options of
   - Advanced wastewater treatment and discharge to Pensacola Bay
   - Advanced secondary treatment and discharge to Pensacola Bay
   - Secondary treatment with discharge by Gulf outfall

2. Scenic Hills facility continuing to operate at secondary level of treatment with disposal by land application

3. Avondale facility continuing to operate at capacity with treatment/disposal options of
   - Secondary treatment with disposal by land application
   - Advanced secondary treatment with discharge to Perdido Bay
   - Advanced secondary treatment with deep-well injection

4. Warrington facility continuing to operate at secondary level of treatment with disposal by land application

5. On-site and small community systems continued for Southwest Escambia County area.

f. No Action

The No Action Alternative is a scenario in which current wastewater management practices would continue.

Until 1981, the wastewater management needs over most of the area were provided by the City of Pensacola and the Escambia County Utility Department. These two entities owned and operated multiple wastewater treatment plants and collection systems. Although they were separate governmental units, they cooperated in providing wastewater service with portions of the county contributing flows to the city's treatment plants. In 1981, in order to further their ability to serve the wastewater (and water) needs of the area, the city and county formed the Escambia County Utilities Authority that is responsible for all wastewater management needs in Escambia County, except Santa Rosa Island, which has a separate Authority.

Based on this background, it is concluded that in the event of no federal action, the wastewater needs of the area would be responsively served by the new Authority. However, the lack of federal funds could reduce the feasibility accomplishing needed capital improvements on existing facilities.

Under the No Action Alternative, the Main Street wastewater treatment plant would be used to maximum capacity through increased service needs and through closing of the Pen Haven, Avondale, Moreno Courts, and Warrington treatment plants. In fact, flows from the Pen Haven plant (closed prior to October 1, 1983) and a portion of the Avondale flows are already conveyed to the Main Street plant. Moreno Courts discharges to percolation ponds; hence they have removed their discharge to Bayou Chico. Wastewater service would be extended to the northwest area of the study area with treatment at the Main Street facility as development dictates. The Scenic Hills plant would continue to operate, as in the case of the other management alternatives. The southwest area will most likely be served through on-site systems and small package plants funded by private developers. The Avondale and Warrington plants cannot continue under existing conditions since Florida DER has determined these discharges must be eliminated.

This scenario is essentially the same as Regional Alternative III except for the method of serving the southwest area and the probable phasing in constructing certain wastewater facilities.

Table II-10 summarizes the treatment and disposal options associated with each wastewater management alternative for Pensacola/Escambia County.

Table II-10. Summary of Alternatives.

Escambia County

Structural Alternative	Treatment Level/Disposal Location
1. 201 Facility Plan	
a. Pensacola - Main Street WWTP	- AWT - Pensacola Bay
b. Scenic Hills - Scenic Hills WWTP	- secondary - Land Application
c. All other areas - Southwest WWTP	- secondary - Gulf Outfall
2. Regional Alternative I	
a. Pensacola and all areas except Scenic Hills - Expanded Main Street WWTP	- AWT - Pensacola Bay - advanced secondary - Pensacola Bay - secondary - Gulf Outfall
b. Scenic Hills - Scenic Hills WWTP	- secondary - Land Application
3. Regional Alternative II	
a. Pensacola and all areas except Scenic Hills - Main Street WWTP to operational capacity	- AWT - Pensacola Bay - advanced secondary - Pensacola Bay - secondary - Gulf Outfall
b. Scenic Hills - Scenic Hills WWTP	- secondary - Land Application
c. Avondale and areas not served by Main Street and Scenic Hills - Avondale STP	- secondary - Land Application - advanced secondary - Perdido Bay discharge - advanced secondary - Deep well injection

Table II-10. Continued

Escambia County

Structural Alternative	Treatment Level/Disposal Location
4. Regional Alternative III	
a. Pensacola and all areas except Scenic Hills and Southwest - Main Street WWTP	- AWT - Pensacola Bay - advanced secondary - Pensacola Bay - secondary - Gulf Outfall
b. Scenic Hills - Scenic Hills WWTP	- secondary - Land Application
c. Southwest - New Southwest WWTP	- secondary - Land Application - advanced secondary - Perdido Bay discharge - advanced secondary - Deep well injection
5. Local Alternatives with no expansion	
a. Pensacola - Pen Haven; areas not served by Avondale, Warrington and Scenic Hills - Main Street WWTP	- AWT - Pensacola Bay - advanced secondary - Pensacola Bay - secondary - Gulf Outfall
b. Scenic Hills - Scenic Hills WWTP	- secondary - Land Application
c. Avondale - Avondale WWTP	- secondary - Land Application - advanced secondary - Perdido Bay discharge - advanced secondary - Deep well injection
d. Warrington - Existing WWTP	- secondary - Land Application
e. Southwest	- individual on-lot and small community systems
6. No Action	- same as Regional Alternative III except that the Southwest area will be served by individual on-lot and small community systems, and implementation may be phased.

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

2. Santa Rosa Island/Gulf Breeze Peninsula

Four regional concepts for wastewater management were also developed for Santa Rosa Island/Gulf Breeze Peninsula, including the 201 Facilities Plan recommendations. In addition, two subregional alternatives, a local alternative, and a No Federal Action scenario were developed and evaluated. These alternatives are described in greater detail below.

a. 201 Facilities Plan

The 201 Facilities Plan for the Gulf Breeze Peninsula and Santa Rosa Island has several major components:

1. Wastewater collection and conveyance from Gulf Breeze and Pensacola Beach via a force main east along U. S. Highway 98 to the regional treatment facility in South Santa Rosa County
2. Wasteflows from Santa Rosa Shores, Woodlawn Beach and Navarre Beach would be connected via small force mains into the major force main for conveyance to the regional facility
3. The regional facility would treat wastewater to the secondary level with disposal of effluent by land application at a site adjacent to Eglin Air Force Base on the peninsula (proposed site indicated in the 201 Facilities Plan is not available).

b. Regional Alternative I

Regional Alternative I has three major components that vary from the concept presented in the 201 Facilities Plan. It has been determined through investigations during the EIS that land application from a regional facility to a site on Eglin Air Force Base is not viable due to the unavailability of land. Consequently, the following regional concept is proposed:

1. Conveyance of wastewater flows from Gulf Breeze, Pensacola Beach, Santa Rosa Shores, Gulf Isles, and western Gulf Breeze Peninsula to Main Street facility with treatment/disposal options of
    - Secondary treatment with discharge to Pensacola Bay
    - Advanced secondary treatment with existing discharge to Pensacola Bay
    - Secondary treatment with Gulf outfall

2. Continuance of Navarre Beach facility to capacity with treatment/disposal options of
    - Secondary treatment with existing discharge to Santa Rosa Sound
    - Advanced secondary treatment with existing discharge to Santa Rosa Sound
    - Secondary treatment with disposal by land application

3. Continuance of on-site and small community systems for Navarre and eastern Gulf Breeze Peninsula.

c. Regional Alternative II

Regional Alternative II will evaluate the treatment and discharge options for a regional Gulf Breeze treatment plant and the existing Navarre Beach treatment plant while continuing the on-site and small community systems for other areas. The following regional concept is proposed:

1. Conveyance of wastewater flows from Gulf Breeze, Pensacola Beach, Santa Rosa Shores, Gulf Isles, and western Gulf Breeze Peninsula to Gulf Breeze facility with treatment/disposal options of
    - Secondary treatment with land application
    - Advanced secondary treatment with existing discharge to Santa Rosa Sound
    - Secondary treatment with existing discharge to Santa Rosa Sound
    - Secondary treatment with discharge to Pensacola Bay

Areas outside this regional system would be handled as in Regional Alternative I:

2. Continuance of Navarre Beach facility to capacity with treatment/disposal options of
    - Secondary treatment with existing discharge to Santa Rosa Sound
    - Advanced secondary treatment with existing discharge to Santa Rosa Sound
    - Secondary treatment with disposal by land application

3. Continuance of on-site and small community systems for Navarre and eastern Gulf Breeze Peninsula.

d. Regional Alternative III

Regional Alternative III will evaluate the treatment and discharge options for a new regional eastern Gulf Breeze treatment plant and the existing Navarre Beach treatment plant while continuing the on-site and small community systems. The following regional concept is proposed:

1. Conveyance of wastewater flows from Gulf Breeze, Pensacola Beach, Santa Rosa Shores, Gulf Isles, and western Gulf Breeze Peninsula to a new Eastern Gulf Breeze facility with
    - Secondary treatment with new discharge to Pensacola Bay
    - Secondary treatment with land application

Areas outside this regional system would be handled as in Regional Alternative I

2. Continuance of Navarre Beach facility to capacity with treatment/disposal options of
    - Secondary treatment with existing discharge to Santa Rosa Sound
    - Advanced secondary treatment with existing discharge to Santa Rosa Sound
    - Secondary treatment with disposal by land application

3. Continuance of on-site and small community systems for Navarre and eastern Gulf Breeze Peninsula.

e. Subregional Alternative I

Subregional Alternative I will combine Gulf Breeze and Pensacola Beach into a single treatment facility. The remaining areas of the Gulf Breeze Peninsula and Santa Rosa Island will be assumed to be too sparsely populated, with population centers too far apart to warrant combination of facilities. The following subregional concept is proposed:

1. Conveyance of wastewater flows from Gulf Breeze and Pensacola Beach to the Main Street facility with
   - Secondary treatment with land application
   - Advanced secondary treatment with discharge to Pensacola Bay
   - Secondary treatment with discharge to Pensacola Bay
   - Secondary treatment with Gulf outfall

2. Continuance of existing Santa Rosa Shores facility at secondary level of treatment with disposal by land application

3. Continuance of existing Gulf Isles facility at secondary level of treatment with discharge to percolation pond

4. Continuance of existing Navarre Beach facility with treatment/disposal options of
   - Secondary treatment with existing discharge to Santa Rosa Sound
   - Advanced secondary treatment with existing discharge to Santa Rosa Sound
   - Secondary treatment with disposal by land application

5. Continuance of on-site and small community systems for Navarre and eastern and western Gulf Breeze Peninsula.

f. Subregional Alternative II

Subregional Alternative II will evaluate the treatment and discharge options for an expanded Gulf Breeze WWTP and the existing Navarre Beach WWTP while continuing the operation of small existing WWTPs and on-site systems. The following subregional concept is proposed:

1. Conveyance of wastewater flows from Gulf Breeze and Pensacola Beach to the Gulf Breeze facility with treatment/disposal options of
   - Advanced secondary treatment with existing discharge to Santa Rosa Sound
   - Secondary treatment with existing discharge to Santa Rosa Sound.
   - Secondary treatment with discharge to Pensacola Bay.

Areas outside this subregional service area would be handled as in Subregional Alternative I.

2. Continuance of Navarre Beach facility to capacity with treatment/disposal options of
   - Secondary treatment with existing discharge to Santa Rosa Sound
   - Advanced secondary treatment with existing discharge to Santa Rosa Sound

- Secondary treatment with disposal by land application

3. Continuance of on-site and small community systems for Navarre and eastern Gulf Breeze Peninsula.

g. Local Alternative with No Expansion

Five facilities are proposed under this alternative. These are:

1. Continuance of Gulf Breeze facility at secondary level of treatment with existing discharge to Santa Rosa Sound

2. Continuance of Pensacola Beach facility with treatment/disposal options of
   - Secondary treatment with existing discharge to Santa Rosa Sound
   - Advanced secondary treatment with existing discharge to Santa Rosa Sound

3. Continuance of Santa Rosa Shores facility at secondary level of treatment with disposal by land application

4. Continuance of Gulf Isles facility at secondary level of treatment with discharge to percolation pond

5. Continuance of existing Navarre Beach facility with treatment/disposal options of
   - Secondary treatment with existing discharge to Santa Rosa Sound
   - Advanced secondary treatment with existing discharge to Santa Rosa Sound
   - Secondary treatment with disposal by land application

6. Continuance of on-site and small community systems for Navarre and eastern and western Gulf Breeze Peninsula.

h. No Action

The No Action Alternative is one in which current wastewater management practices would continue. Wastewater service in Santa Rosa Island and the Gulf Breeze Peninsula has been provided in several independent and self-sufficient modes:

- o Public institutions - City of Gulf Breeze, Santa Rosa Island Authority (Pensacola Beach), and the Santa Rosa County Beach Administration (Navarre Beach)

- o Private institutions - Gulf Isles and Santa Rosa Shores

- o Individual on-site systems - most of the eastern Gulf Breeze Peninsula.

Currently, independent of other planning efforts, the Santa Rosa Island Authority is undertaking an engineering study for expansion of the Pensacola Beach wastewater treatment plant in response to service needs in that community.

It is expected that in the absence of federal funding the current practice of independently serving each local community would continue. This scenario would essentially be the same as the Local Alternative. However, without federal funding the existing treatment plant discharges into Santa Rosa Sound would probably continue without change at Navarre Beach and possibly Pensacola Beach. This would require local expenditure of funds to meet any increased FDER permit requirements.

Table II-11 summarizes the treatment and disposal options associated with each wastewater management alternative for Santa Rosa Island/Gulf Breeze Peninsula.

Table II-11. Summary of Alternatives.

Santa Rosa Island/Gulf Breeze Peninsula

Structural Alternatives	Treatment Level/Disposal Location
1. 201 Facility Plan - All areas, regional WWTP	- secondary - Land Application
2. Regional Alternatives	
a. Gulf Breeze, Pensacola Beach, Santa Rosa Shores Gulf Isles, and Western Gulf Breeze Peninsula - regional WWTP at Gulf Breeze or eastern peninsula	- Convey to advanced secondary Main St. WWTP - Pensacola Bay - secondary - present discharge, Santa Rosa Sound - secondary - land application - advanced secondary - present discharge, Santa Rosa Sound - secondary - Pensacola Bay discharge
b. Navarre Beach - Existing WWTP	- secondary - present discharge, Santa Rosa Sound - advanced secondary - present discharge, Santa Rosa Sound - secondary - land application
c. Navarre, Eastern Gulf Breeze Peninsula	- on-site, small community systems
3. Subregional Alternatives	
a. Gulf Breeze and Pensacola Beach - subregional WWTP at Gulf Breeze	- convey to advanced secondary Main St. WWTP - Pensacola Bay - secondary - land application - secondary - Santa Rosa Sound - advanced secondary - present discharge, Santa Rosa Sound - secondary - Pensacola Bay
b. Santa Rosa Shores - Existing WWTP	- secondary - land application
c. Gulf Isles - Existing WWTP	- secondary - percolation pond
d. Navarre Beach	- secondary - present discharge, Santa Rosa Sound - advanced secondary - present discharge, Santa Rosa Sound - secondary - land application
e. Navarre, Eastern Gulf Breeze Peninsula, and Western Gulf Breeze Peninsula	- on-site, small community systems
4. Local Alternative	
a. Gulf Breeze - Gulf Breeze WWTP	- secondary - present discharge, Santa Rosa Sound - advanced secondary - present discharge, Santa Rosa Sound - secondary - Pensacola Bay

Table II-11. Continued

Santa Rosa Island/Gulf Breeze Peninsula

Structural Alternatives	Treatment Level/Disposal Location
b. Pensacola Beach - Pensacola Beach WWTP	- secondary - present and new discharge point, Santa Rosa Sound - advanced secondary - present and new discharge point, Santa Rosa Sound
c. Santa Rosa Shores	- secondary - land application
d. Gulf Isles	- secondary - percolation pond
e. Navarre Beach	- secondary - present discharge, Santa Rosa Sound - advanced secondary - present discharge, Santa Rosa Sound - secondary - land application
f. Navarre and Eastern Gulf Breeze Peninsula and Western Gulf Breeze Peninsula	- on-site, small community systems
5. No Action	- same as local alternative except that all facilities will discharge to present location

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

E. Evaluation of Wastewater Management Alternatives

The evaluation of alternatives involves the consideration of several criteria including costs, implementability, operability/reliability, energy consumption, and environmental impacts. This section provides an evaluation of costs, implementability, reliability and energy consumption for all alternatives by service area and treatment facility. Environmental impacts and associated mitigation measures are discussed in Chapter III.

Costs are determined only for capital expenditures, operation and maintenance, and total present worth costs of the wastewater management facilities. Costs are not calculated for potential benefits or degradation of the environment. The present worth analysis task establishes a total cost value of the capital expenditures and operating costs of each alternative over the duration of the planning period. The present worths for the wastewater management alternatives are developed for a 17-year planning period ending in the year 2000 using an interest rate of 7 3/8 percent. In accordance with EPA guidelines, allowances are made for salvage values at the end of the planning period. Capital and annual operating costs have been estimated for the collection, conveyance, treatment and disposal systems that constitute the alternatives. The unit costs have been estimated in 1981 dollars from literature and actual data available to Gannett Fleming Corddry and Carpenter, Inc., and from EPA handbooks. Capital costs include the costs of equipment and construction plus 30 percent for engineering, inspection, financing, rights-of-way, and contingencies.

The prospects for successful implementation of a wastewater treatment alternative must be addressed in view of both public and institutional realities within the study area. To evaluate the implementability of alternative wastewater management systems, factors such as public acceptability, institutional concerns, and planning flexibility are considered.

The reliability of a wastewater management system may be defined as a measurement of the ability of a system to perform its designated function without failure. Failure in this situation would be the inability to consistently achieve and maintain the effluent quality standards for which the system was designed. Three reliability classes are associated with wastewater treatment facilities (USEPA 1974):

- Reliability Class I--Treatment facilities that discharge into navigable waters that could be permanently or unacceptably damaged in only a few hours by poor quality effluent. Requirements for Class I facilities are some type of surge-control device, back-up units for all major pieces of equipment, and standby power.

- Reliability Class II--Treatment facilities that discharge into navigable waters that would be permanently or unacceptably damaged by long-term (several days) effluent-quality degradations. For secondary treatment systems, requirements for Class II facilities are similar to those for Class I facilities.

- Reliability Class III--All other treatment facilities not covered under Class I and Class II. Some standby power is required, as are certain basic redundancy requirements, such as extra pumps and blowers.

1. Main Street

a. Costs

The costs of operation for the Main Street treatment plant have been developed for each of the alternatives based on a detailed analysis of current operating practices and cost experience. Certain capital improvements required to operate at high flow rates were also priced. The costs for the Main Street plant are displayed in Table II-12. The major component of the present worth of the plant is the operating cost. Due to significant fixed costs of operation, the increased utilization of this facility results in greater overall economy of operation.

Also displayed in the table are the costs of disposal, including construction of the Gulf outfall as an alternative. The overall cost evaluation indicates that the discharge to the Gulf of Mexico is the most costly solution.

b. Implementability

The Main Street treatment plant will be under the control of the Escambia County Utilities Authority, and any modifications required can be undertaken by the Authority. Implementation of the Gulf outfall alternative will be more difficult than other options due to the uncertainties associated with siting and constructing the outfall. The use of the existing plant for advanced wastewater treatment is not considered feasible; the experience nationwide with the processes employed has not resulted in effective advanced treatment, although once considered proper for this application.

c. Operability/Reliability

The Main Street treatment plant is currently operated effectively with a full complement of operations and maintenance personnel. The reliability of the plant in an advanced secondary or secondary treatment level mode is considered to be good. Because of the complex mechanical design of this plant, its operability rates are lower than others, but with proper staffing this is not a problem.

d. Energy Commitment

The processes employed at the Main Street treatment plant are generally energy intensive. The oxygen generation equipment alone consumes approximately one-third of the total plant power, and it cannot efficiently operate at low plant flows. Numerous in-plant pumping steps require electric power, and the sludge processing equipment is energy intensive. However, various process operation changes have been implemented to reduce costs, including energy costs. Foremost among these changes was the change in chemical addition, resulting in less inert sludge to be processed in the incinerators. This has resulted in an autogenous (requiring no supplemental fuel) burning of sludge in the incinerators.

The most significant conclusion to be drawn is that maximizing the use of this treatment plant will reduce the unit cost of operation and the unit

Table II-12. Main Street Wastewater Treatment Plant Capital and Operating Costs and Present Worths (Thousands of Dollars)

Treatment Level Disposal Alternative	Secondary[9] Gulf Outfall	Adv. Secondary Pensacola Bay[10] Outfall
Treatment Plant[1]		
Capital Cost	947	1,087
Annual O & M	3,526	4,763
Present Worth	30,188	40,553
Disposal Facility[1]		
Capital Cost	32,804	2,699
Annual O & M	332	8
Present Worth	29,595	2,244
Total Present Worth		
23.6 mgd capacity[1]	59,783	42,797
16.4 mgd capacity[2]	56,502	37,174
20.5 mgd capacity[3]	57,705	39,336
20.9 mgd capacity[4]	57,804	39,511
24.1 mgd capacity[5]	60,423	43,561
26.3 mgd capacity[6]	62,532	45,332
26.8 mgd capacity[7]	62,714	45,515
27.3 mgd capacity[8]	62,865	45,712

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[1] Based on 23.6 mgd capacity associated with Alternative III
[2] 201 Facility Plan
[3] Local Alternative
[4] Alternative II
[5] Alternative I
[6] Alternative III combined with Santa Rosa Sub Regional
[7] Alternative I combined with Santa Rosa Sub Regional
Alternative III combined with Santa Rosa Regional
[8] Alternative I combined with Santa Rosa Regional
[9] Outfall costs based on 10,000 ft. unburied pipe
[10] Outfall costs for unburied pipe

commitment of energy. In addition, more thorough evaluations of the plant process mode may result in additional economies.

2. Avondale

a. Costs

The capital and annual operating costs associated with the Avondale treatment plant, along with present worths for the various treatment and disposal options, are presented in Table II-13. The costs of conveyance of Avondale flows to the Main Street plant include the conveyance costs presented in Table II-23.

b. Implementability

The creation of the Escambia County Utility Authority increases the implementability of those alternatives which propose routing flows to the Main Street treatment plant. Since this plant is operating with a temporary permit, is slated for phase out in 1985, and is already conveying a portion of its flows to the Main Street plant, total phase out with conveyance of all flows to the Main Street plant appears most implementable.

c. Operability/Reliability

Escambia County has maintained efficient operation at the Avondale wastewater treatment facility, with no history of water quality violations. The reliability class associated with the present operation is Reliability Class 2. Adequate attention to operation is anticipated whether the plant is operated at capacity or expanded.

d. Energy Consumption

The contact-stabilization process currently used at the Avondale facility requires an average energy and resource commitment for this size of facility. Treatment of all Avondale flows at Main Street, however, would require less energy and resource consumption than operating an expanded Avondale facility because there would be no duplication of facilities and unit processes. Conversely, continuing to operate the Avondale facility at existing capacity while routing excess flows to Main Street would require greater energy and resource consumption than operating an expanded facility.

3. Warrington

The Moreno Courts wastewater treatment facility has been included in the Warrington service area. However, they have maintained their own facility and currently discharge to percolation ponds adjacent to Jones Swamp Creek. This 210,000 gpd activated sludge facility is 40 years old and has an average flow of only 70,000 gpd. The Warrington facility has a temporary operating permit, valid until December 1, 1984. Plans are under way to convey its flows to the Main Street plant.

a. Costs

The capital and operating costs of continuing to operate the Warrington facility at the existing capacity are included in the summary presented in

Table II-13. Avondale Wastewater Treatment Plant Capital, Operating Costs and Present Worths
(Thousands of Dollars)

	Local Alternative			Regional Alternative II		
Capacity (mgd)	1.0	1.0	1.0	3.22	3.22	
3.22 Treatment Level	Secondary	Adv. Secondary[1]	Adv.			
Secondary	Secondary	Adv. Secondary[1]	Adv. Secondary			
Disposal Method	Spray Irrigation	Perdido Bay Dis.	Deep Well Injection	Spray Irrigation	Perdido Bay Dis.	Deep Well Injection
Treatment Plant						
Capital Cost	0	1,400	1,400	6,600	9,870	9,870
Annual O & M	117	218	218	243	1,270	1,270
Present Worth	879	2,850	2,850	7,580	11,500	11,500
Disposal Facility						
Capital Cost	3,998	1,050	1,352	13,782	1,477	2,568
Annual O & M	65	15	23	176	20	74
Present Worth	3,676	777	1,324	12,227	1,429	2,797
Total Present Worth	4,555	3,627	4,174	19,807	12,929	14,297

[1] Outfall costs for unburied pipeline

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

Table II-14. The costs of conveyance of Warrington flows to Main Street are included in the conveyance costs presented in Table II-23.

b. Implementability

No serious implementability problems exist with either of the alternatives proposed for the Warrington service area. In the past, Escambia County has been responsible for the operation and maintenance of the Warrington treatment plant. The Escambia County Utilities Authority has taken over the operation of the wastewater systems once operated by the City of Pensacola and Escambia County. The creation of this Escambia County Utility Authority increases the implementability of both alternatives because each proposes routing flows to the Main Street plant.

The alternative which proposes routing all Warrington flows to Main Street is considered to be more implementable because under Regional Alternative II, no expansion of Main Street is expected, and under Regional Alternatives I and III, the expected expansion of Main Street would also provide capacity for other areas of Escambia County. The Local Alternative, which proposes continued operation of the Warrington facility, is less implementable in the Warrington service area because of the necessity of land application and the long lead time associated with that construction. In addition, a suitable site for land application is approximately six miles from the plant.

c. Operability/Reliability

Escambia County has maintained an efficient operation at the Warrington wastewater treatment facility, with no history of water quality permit violations. The reliability class associated with the present operation is Reliability Class 2. It is anticipated that adequate attention to operation would continue to be provided in the future.

Operability/reliability will be higher, however, if all wastewater flows from the Warrington service area are routed to the Main Street facility because of increased staff size and centralization of effort.

d. Energy Consumption

The extended aeration process, currently used at the Warrington facility, is considered to require an approximately average energy and resource commitment for this size of facility. Treatment of all Warrington flows at Main Street, however, would require less energy and resource consumption than operating the existing facility, because there would be no duplication of facilities and unit processes.

4. Northwest Escambia County

Sewer service is currently not extensive in the Northwest. It is expected that one-half of the currently unserved population and one-half of the population growth will have sewer service by the year 2000. The served population will be mostly located in the southeastern portion of this Northwest service area. Sewer service is expected under all alternatives. Ordinarily, flows were to be routed to either the Avondale facility or Main

Table II-14. Warrington Wastewater Treatment Plant Capital, Operating Costs and Present Worths (Thousands of Dollars).

Capacity (mgd)	2.01
Treatment Level	Secondary
Disposal Method	Land Application
Treatment Plant	
Capital Cost	0
Annual O & M	195
Present Worth	1,465
Disposal Facility	
Capital Cost	10,313
Annual O & M	147
Present Worth	9,422
Total Present Worth	10,887

[1] Local Alternative

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

Street. Since the Avondale facility is to be closed in 1985, however, flows will need to be routed to the Main Street facility. This could affect ordinances and development alternatives influencing the generation, conveyance and treatment of wastewater from this area.

a. Costs

The costs of conveyance of Northwest flows are included in the summary presented in Table II-23.

b. Implementability

No serious implementability problems are associated with conveying flows from the Northwest to an existing treatment facility. The Escambia County Utilities Authority would have jurisdiction over the service area. The creation of the Escambia County Utility Authority increases the implementability of routing Northwest flows to Main Street.

c. Operability/Reliability

No serious operability/reliability problems are associated with conveying flows from the Northwest to an existing treatment facility.

d. Energy Consumption

Treatment of Northwest wastewater at a centralized treatment facility represents an efficient use of energy and resources because there would be no duplication of facilities and unit processes.

5. Southwest Escambia County

Several alternatives have been considered for Southwest Escambia County. The 201 Facilities Plan proposes a regional 7.7 mgd plant with a Gulf outfall in the Southwest which would serve all of Escambia County in the study area except the city of Pensacola. Regional Alternative III proposes a subregional 0.54 mgd facility which would only serve the Southwest. Disposal options for this facility include discharge to Perdido Bay, deep-well injection, and land application. Sewer service to the Southwest is also proposed in the other two regional alternatives where flows from the Southwest facility are routed to Main Street. Finally, in the Local Alternative, no major sewer service is proposed for the Southwest. Rather, the area is expected to continue using on-site systems and package plants for wastewater service. Perdido Key is considered separately and as part of the larger Regional Alternatives as well. It is considered separately for funding considerations since it is a barrier island and involves more issues than most mainland areas.

a. Costs

The capital and annual operating costs along with present worth of the various treatment and disposal options are presented in Table II-15. The costs of conveyance of southwestern flows to Main Street are included in the summary presented in Table II-23.

Table II-15. Southwest Wastewater Treatment Plant Capital, Operating Costs and Present Worths (Thousands of Dollars)

	201 Plan	Regional Alternative III		
Capacity (mgd)	7.7	0.5	0.5	0.5
Treatment Level	Secondary[1]	Secondary	Adv. Secondary[2]	Adv. Secondary
Disposal Method	Gulf Outfall	Land Application	Per. Bay Outfall	Deep Well Injection
Treatment Plant				
Capital Cost	13,700	2,100	2,920	2,920
Annual O & M	585	31	94	94
Present Worth	16,295	2,058	3,250	3,250
Disposal Facility				
Capital Cost	11,319	1,611	497	910
Annual O & M	108	21	14	15
Present Worth	10,057	1,511	542	886
Total Present Worth	26,352	3,569	3,792	4,136

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[1] Outfall cost based on 10,000 ft. unburied pipeline

[2] Outfall costs for unburied pipeline.

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

b. Implementability

This area is also under the jurisdiction of the Escambia County Utilities Authority. The most implementable alternative for Southwest Escambia County would be the Local Alternative because no major construction is proposed and the long lead times associated with that construction would be avoided. The next most implementable alternative would be routing the Southwest Escambia County flows to Main Street. Conversely, the least implementable alternative would be that which proposes the greatest amount of new construction--the regional 7.7 mgd facility.

c. Operability/Reliability

The level of operability/reliability will be higher for those alternatives which propose the use of regional treatment plants because of increased staff size and centralization of effort.

d. Energy Consumption

If sewer service was not provided to Southwest Escambia County and on-site systems were the major type of wastewater service utilized, the localized alternative would have the least requirement for energy and resources. Of the regional alternatives, however, those alternatives which propose conveyance of the southwest flows to Main Street would require the least commitment of energy and resources, because there would be no duplication of facilities and unit processes.

6. Scenic Hills

Under all alternatives the Scenic Hills facility will continue in operation. Projected year 2000 flow is 0.90 mgd which could be accommodated by the existing capacity.

a. Costs

Because costs of continued operation of the Scenic Hills facility would be the same for every alternative, they would have no impact on a comparative economic analysis of the alternatives. The costs are shown in Table II-16.

b. Implementability

At the present time 70 percent of the Scenic Hills treatment plant's excess capacity is allocated to one developer. Depending on future events, this may or may not be an obstacle to utilizing this capacity.

c. Operability/Reliability

The City of Pensacola has maintained an efficient operation at the Scenic Hills wastewater treatment facility, with no history of permit violations. The reliability class associated with the present opeation is Reliability Class 2. It is anticipated that adequate attention to operation will continue to be provided in the future.

Table II-16. Scenic Hills Wastewater Treatment Plant Capital, Operating Costs and Present Worths (Thousands of Dollars).

Treatment Level Disposal Method Required Capacity	Secondary Land Application 0.90 mgd
Treatment Plant	
Capital Cost	0
Annual O & M	66
Present Worth	496
Disposal Facility	
Capital Cost	0
Annual O & M	38
Present Worth	362
Total Present Worth	858

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

d. Energy Consumption

The treatment process currently utilized at the Scenic Hills facility requires an average energy and resource commitment for this size of facility. Spray irrigation requires a higher energy commitment than surface water discharge.

7. Gulf Breeze

a. Costs

The capital and annual operating costs for the different treatment facility and disposal options are presented in Table II-17. Present worths of these costs are also displayed in the table. Similar costs are shown for the potential East Gulf Breeze plant in Table II-18. The costs of conveyance associated with transmission of the wastewater to Main Street are presented in Table II-24.

b. Implementability

All the areas proposed to be served under the Regional Alternative (except Midway) and the Subregional Alternative currently have wastewater treatment facilities which are operated and maintained by local authorities. The Local Alternative is considered to be the most implementable because there would be no need for coordination of facilities construction, expansion, or operation with these other local authorities. The alternatives involving joint treatment with other local authorities are considered the least implementable for the aforementioned reasons and due to the long lead time that would be required to construct a joint wastewater treatment facility.

c. Operability/Reliability

The City of Gulf Breeze maintains an efficient operation at the wastewater treatment facility. The reliability class associated with the present operation is Reliability Class 2. It is anticipated that a facility expanded to 0.80 mgd would continue to receive adequate attention to operation. If, however, wastewater is conveyed to a regional facility, both operability and reliability may be improved due to increased staff size and newness of the facility.

d. Energy Consumption

Energy consumption to treat wastewater could cost less at a regional facility since there would not be a duplication of facilities and unit processes. However, the current process used in this facility requires an average energy and operating resource commitment for the size of facility.

8. Pensacola Beach

In all alternatives, the Pensacola Beach service area is expected to be completely served. The variation will be in location of treatment facility and effluent discharge. Depending on the alternative, treatment will be either at the existing site; existing Gulf Breeze facility; a new facility

Table II-17. Expanded Gulf Breeze Wastewater Treatment Plant Capital, Operating Costs and Present Worth (Thousands of Dollars)

Treatment Level/ Disposal Alternative	Secondary Land Application		Secondary(4) Pensacola Bay		Advanced Secondary(4) Santa Rosa Sound			Secondary(4) Santa Rosa Sound		
	(1)	(2)	(1)	(2)	(2)	(1)	(3)	(2)	(1)	(3)
Capacity	2.83 mgd	3.32 mgd	2.83 mgd	3.32 mgd	3.32 mgd	2.83 mgd	0.8 mgd	3.32 mgd	2.83 mgd	0.8 mgd
Treatment Plant										
Capital Cost	5,700	6,600	5,700	6,600	8,000	7,000	1,900	6,600	5,700	1,400
Annual O & M	207	264	207	264	414	340	162	264	207	61
Present Worth	6,525	7,737	6,525	7,737	11,700	10,000	3,580	7,737	6,525	1,678
Disposal Facility										
Capital Cost	26,960	27,825	1,170	1,170	1,006	1,006	634	1,006	1,006	634
Annual O & M	199	230	19	22	19	15	14	19	15	14
Present Worth	23,237	24,157	1,154	1,529	1,020	978	659	1,020	978	659
Total Present Worth	29,762	31,894	7,679	9,266	12,720	10,978	4,239	8,757	7,503	2,337

(1) Sub Regional Alternative.
(2) Regional Alternative
(3) Local and No Action Alternative
(4) Outfall costs for unburied pipeline.

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

Table II-18. New Gulf Breeze Peninsula Wastewater Treatment Plant Capital, Operating Costs and Present Worths (Thousands of Dollars).

Treatment Level Disposal Alternative Capacity	Secondary[1] Land Application 3.75 mgd	Secondary[2] Land Application 3.32 mgd
Treatment Plant		
Capital Cost	8,100	7,400
Annual O & M	282	264
Present Worth	9,160	8,416
Disposal Facility		
Capital Cost	15,332	13,627
Annual O & M	202	183
Present Worth	13,927	12,312
Total Present Worth	23,087	20,728

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[1] 201 Facility Plan

[2] Regional Alternative

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

for the City of Gulf Breeze; a new facility on the eastern Gulf Breeze Peninsula; or at Main Street. Disposal options consist of land application, discharge to Pensacola Bay, and discharge to Santa Rosa Sound (existing and new disposal sites).

a. Costs

The capital and annual operating costs for the different treatment facility and disposal options are presented in Table II-19. Present worths are also displayed in the table. The costs of conveyance associated with transmission of the wastewater to Guld Breeze, Main Street, or other alternative treatmetn sites are presented in Table II-24.

b. Implementability

Under the Local Alternative and the No Action scenario, the Pensacola Beach facility would be expanded. Under the 201 Facilities Plan, the Regional Alternative and the Subregional Alternative, the Pensacola Beach facility is abandoned and wastewater is conveyed elsewhere for treatment. The implementability of the various alternatives must consider this basic difference.

The existing Pensacola Beach wastewater system is operated and maintained by the Santa Rosa Island Authority which also provides other services in Pensacola Beach. This enables coordinated services in the community in response to needs. In this regard, the Authority is currently undertaking an independent engineering evaluation to determine the most expeditious and cost-effective means of providing required additional wastewater disposal capacity. Recent upgrading of the system has occurred.

Because of the Authority's apparent desire to maintain responsive control of the services in Pensacola Beach, it is considered most implementable to undertake the alternatives involving local treatment and disposal. The alternatives involving joint treatment with other local municipalities are considered least implementable for the aforementioned reasons and due to the long lead time that would be required to construct a new joint wastewater treatment facility.

c. Operability/Reliability

The Santa Rosa Island Authority maintains an efficient operation at the wastewaer treatment facility, which has a history of water quality compliance. The reliability class associated with the present operation is Reliability Class 1. It is anticipated that an expanded facility would continue to receive adequate attention to operation. If, however, wastewater is conveyed to a regional facility, both operability and reliability may be improved due to increased staff size and newness of the facility.

d. Energy Consumption

Energy consumption to treat Pensacola Beach wastewater would cost less at a regional facility since there would not be a duplication of facilities and unit processes. The current process used in this facility requires an average energy and operating resource commitment.

Table II-19. Pensacola Beach Wastewater Treatment Plant Capital and Operating Costs and Present Worth (Thousands of Dollars)

Treatment Level Disposal Alternative Capacity = 2.03 mgd	Secondary[1] Santa Rosa Sound E. of Bridge	Secondary[1] Santa Rosa Sound W. of Bridge	Adv. Secondary[1] Santa Rosa Sound E. of Bridge	Adv. Secondary[1] Santa Rosa Sound W. of Bridge
Treatment Plant				
Capital Cost	2,000[2]	2,000[2]	4,320	4,320
Annual O & M	270	290	265	265
Present Worth	4,300	4,300	4,340	4,340
Disposal Facility				
Capital Cost	800	1,000[2]	800	1,000[2]
Annual O & M	14	18	14	18
Present Worth	800	1,000	800	1,000
Total Present Worth	5,100	5,300	5,140	5,340

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[1] Local and No Action Alternative. Outfall costs for unburied pipe.
[2] Cost estimates provided by Santa Rosa Island Authority for expansion to a 2.4 mgd facility.

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

9. Navarre Beach

a. Costs

The capital costs, annual operating costs and present worths of these costs for Navarre Beach are presented in Table II-20. As illustrated by the table there is no difference in operating cost for the use of existing facilities at the existing treatment level or at the advanced secondary levels. The costs of conveyance across Santa Rosa Sound to a regional wastewater treatment plant are presented in Table II-24.

b. Implementability

Navarre Beach will essentially retain their existing wastewater treatment plant in all alternatives except for the 201 Facilities Plan. The minor operational revisions required to operate the existing treatment plant as advanced secondary could be implemented without major problems. The 201 Facilities Plan, which calls for transporting the wastewater across Santa Rosa Sound, is an expensive alternative and probably would not be implemented without substantial federal funding. On the other hand, it is anticipated that FDER will issue a zero discharge order for this portion of Santa Rosa Sound, and therefore it may not be possible to continue local discharge within the regulations.

c. Operability/Reliability

The Santa Rosa County Beach Administration currently operates a very reliable facility with minimal water quality violations. The reliability class associated with the present facility is Reliability Class 2. It is anticipated that the facility will continue to operate as it has in the past. If, however, wastewater is conveyed to a regional facility, both operability and reliability may be improved due to increased staff size and newness of the facility.

d. Energy Consumption

Energy consumption to treat Navarre Beach wastewater would cost less at a regional facility since there would not be a duplication of facilities and unit processes. However, the current process used in this facility is considered to require average energy and operating resource commitments for this size of facility.

10. Gulf Breeze Peninsula

Both the 201 Facility Plan and the Regional Alternatives propose to abandon the existing Santa Rosa Shores and Gulf Isles treatment plants. Under these alternatives, a regionalized treatment plant would be built either at Gulf Breeze or at the 201 Facility Plan site in the Gulf Breeze Peninsula.

The 201 Facility Plan treatment plant would serve all of the Gulf Breeze Peninsula in addition to Pensacola Beach and Navarre Beach. The wastewater treatment capacity required is estimated to be 3.75 mgd.

Table II-20. Navarre Beach Wastewater Treatment Plant Capital, Operating Costs and Present Worths (Thousands of Dollars).

Treatment Level[1] Disposal Alternative Capacity = 0.25 mgd	Secondary Land Application	Secondary Santa Rosa Sound	Advanced Secondary Santa Rosa Sound
Treatment Plant			
Capital Cost	0	0	154
Annual O & M	24	24	24
Present Worth	180	180	615
Disposal Facility			
Capital Cost	2,764	0	0
Annual O & M	40	2	2
Present Worth	2,320	19	19
Total Present Worth	2,500	199	333

[1] All alternatives except 201 Facility Plan

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

The regional alternative proposes to transport wastewater to Main Street or to build a new treatment plant either at the 201 Facility Plan site or at Gulf Breeze. This alternative would serve the same service areas as the 201 Facility Plan except for Navarre Beach and Navarre. Estimated wastewater production is 3.32 mgd for the regional alternatives.

Subregional, Local, and No Action Alternatives propose to keep the Gulf Isles and Santa Rosa Shores treatment plants in operation through the year 2000. These alternatives project wastewater flows of 0.18 mgd for Gulf Isles and 0.17 mgd for Santa Rosa Shores.

The 1981 peak monthly flow to Gulf Isles was 0.15 mgd, which is well within the 0.35 mgd plant capacity, as is the projected year 2000 flow of 0.18 mgd. The peak monthly flow to Santa Rosa Shores was 0.203 mgd, which exceeds the existing plant capacity of 0.13 mgd. All flows in excess of Santa Rosa Shores plant capacity are assumed to be transferred to Gulf Isles during the planning period, raising the year 2000 flow to Gulf Isles to 0.22 mgd.

Disposal options consist of the existing disposal by land application for Santa Rosa Shores and discharge to percolation pond for Gulf Isles. The regional alternatives disposal options consist of land application, discharge to Pensacola Bay, and discharge to Santa Rosa Sound.

a. Costs

The capital and annual operating costs for the different treatment facility and disposal options are presented in Tables II-21 and II-22. Present worths of these costs are also displayed in the tables. The costs of conveyance associated with transmission of the wastewater to Gulf Breeze, Main Street, or other alternative treatment sites are presented in Table II-24.

b. Implementability

Under the Local Alternative, Subregional Alternative, and the No Action scenario, the Santa Rosa Shores and Gulf Isles treatment plants will remain essentially the same except for a conveyance line between them to take the excess flows from Santa Rosa Shores to Gulf Isles. This plan would need to be acceptable to both facility owners to be implementable. Since these alternatives require limited new construction, they may be easily implemented.

The 201 Facilities Plan and regional alternative propose to construct major conveyance lines and new or expanded treatment plants. Since these alternatives would involve coordination of new facilities construction and operation with other municipalities, these alternatives are considered the least implementable.

c. Operability/Reliability

Santa Rosa Shores' treatment plant is hydraulically overloaded periodically and occasionally has water quality violations. Gulf Isles, on the other hand, has capacity in excess of the projected year 2000 flows. The transportation of the Santa Rosa Shores excess flows to Gulf Isles is

Table II-21. Santa Rosa Shores Wastewater Treatment Plant Capital, Operating Costs and Present Worths (Thousands of Dollars).

Treatment Level Disposal Alternative WWTP Capacity Required = 0.17 mgd	Secondary Land Application
Treatment Plant	
Capital Cost	0
Annual O & M	16
Present Worth	120
Disposal Facility	
Capital Cost	0
Annual O & M	20
Present Worth	190
Total Present Worth	310

---

[1] Subregional, Local and No Action Alternatives. Flows in excess of existing plant capacity of 0.13 mgd are assumed to be routed to Gulf Isles Facility.

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

Table II-22. Gulf Isles Wastewater Treatment Plant Capital, Operating Costs and Present Worths (Thousands of Dollars).

Treatment Level[1] Disposal Alternative WWTP Capacity = 0.18 mgd	Secondary Percolation Pond
Treatment Plant	
Capital Cost	0
Annual O & M	17
Present Worth	128
Disposal Facility	
Capital Cost	0
Annual O & M	17
Present Worth	159
Total Present Worth	287

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[1] Subregional, Local and No Action Alternatives. May also treat up to 0.04 mgd excess flow from Santa Rosa Shores Plant.

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

expected to improve the reliability of the Santa Rosa Shores plant. The reliability class associated with the present operation of the Santa Rosa Shores plant is Reliability Class 2. If wastewater is conveyed to a regional facility rather than continuing operation of both treatment plants, both operability and reliability may be improved due to increased staff size and newness of the facility.

d. Energy Consumption

Energy consumption to treat Gulf Breeze Peninsula wastewater would cost less at a regional facility since there would not be a duplication of facilities and unit processes. However, the current process used in both Santa Rosa Shores and Gulf Isles facilities requires an average energy and operating resource commitment for this size of facility.

Table II-23. Wastewater Conveyance Facilities for Escambia County Capital and Operating Costs and Present Worths (Thousands of Dollars)

	Capital Cost	Annual Operating Cost	Present Worth
201 Plan	48,648	280	38,484
Regional Alternative I	11,848	237	11,881
Regional Alternative II	13,433	243	13,208
Regional Alternative III (1)			
(a)	8,782	175	8,921
(b)	5,433	131	5,716
Local Alternative	8,434	98	6,370
No Action	2,873	51	2,878

(1) (a) - Disposal of effluent from proposed southwest plant to Perdido Bay.
(b) - Disposal of effluent from proposed southwest plant via spray irrigation.

Note: Conveyance costs for Avondale and Warrington are based on data provided by the Escambia County Utilities Authority.

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

Table II-24. Wastewater Conveyance Facilities for Santa Rosa County Capital and Operating Costs and Present Worths (Thousands of Dollars)

	Capital Cost	Annual Operating Cost	Present Worth
201 Plan	16,765	200	13,813
Regional Alternative (1)			
(I)	13,367	178	12,723
(II)	6,715	118	6,702
(III)	13,392	175	12,779
Subregional Alternative (2)			
(I)	3,298	52	3,078
(II)	9,539	106	8,668
Local Alternative	629	9	603
No Action	629	9	603

(1) I - Treatment at Main Street
II - Treatment at existing Gulf Breeze plant site
III - Treatment at eastern Gulf Breeze Peninsula plant site

(2) I - Treatment at existing Gulf Breeze plant site.
II - Treatment at Main Street.

Source: Gannett Fleming Corddry and Carpenter, Inc. 1981.

F. Final Screening of Alternatives

The alternatives presented in previous sections represent those most likely to be considered for implementation. Numerous factors affect the evaluation process, including environmental impacts, costs, implementability and effluent limitations. An additional factor in this EIS is the combination of City of Pensacola and Escambia County Utilities into the Escambia County Utilities Authority. The development of the Utilities Authority placed all Escambia County wastewater facilities (except Santa Rosa Island) under their jurisdiction. This significantly influences the implementability of regional alternatives conveying effluent to the Main Street plant. Additionally, the Utilities Authority proceeded under consent decrees imposed by the State DER to close Pen Haven and begin planning the phase out of the Avondale and Warrington plants. The least costly alternative of those available to the Authority was to plan conveyance to the Main Street facility.

The Santa Rosa Island Authority also proceeded independently with plans to upgrade and increase the size of their wastewater facility on Santa Rosa Island. Upgrading has been completed and expansion is now being planned. These measures were taken due to increased flows from an expanding population and requirements of DER.

Perdido Key has been served historically by on-site and small community systems. With increased development pressure, however, the Escambia County Utilities Authority is considering sewer service to the area. A District I Master Wastewater Plan concerning the conveyance and treatment of wastewater generated from southwest Escambia County, including Perdido Key, was completed in January 1984.

These factors are all important in the final screening of alternatives. Some alternatives not considered past the development phase of the EIS have been pursued by the wastewater management authorities. For example, location of a treatment facility on Perdido Key to serve Perdido Key was ruled out by the EIS due to location in the 100-year floodplain and other environmental considerations. However, the Authority is considering this alternative as an option for servicing the Perdido Key area. Therefore, this alternative is included in the final screening of alternatives for comparative purposes with other alternatives more fully considered by the EIS. The final comparison of alternatives includes:

1. The 201 Plan alternatives
2. The alternatives currently being considered by the wastewater management authorities
3. The alternatives considered most cost-effective and environmentally acceptable based on EIS.

The present worth costs shown on the following pages are based predominantly on costs developed during the Alternatives Evaluation phase of the EIS. More current cost data have become available for conveyance of Avondale and Warrington flows to the Main Street plant and expansion of the Pensacola Beach plant. These figures have been incorporated into the total present worth costs. Costs for the continued operation and maintenance and, if necessary, expansion of the Main Street and Scenic Hills plants are not included in the total present worth costs for Escambia County alternatives.

The addition of these figures would have little effect on the relative differences in the costs as presented.

1. Escambia County

The Escambia County portion of the study area includes the Northwest, Scenic Hills, Main Street, Avondale, Pen Haven, Warrington, Southwest and Perdido Key subareas (see Figure II-1). All alternatives include the maintenance of current wastewater management practices for Scenic Hills. All alternatives include maintenance of the Main Street plant at its existing 20 mgd capacity.

Alternative 1

This alternative provides centralized wastewater service with a new Southwest County treatment plant. This plant would have secondary treatment with discharge by outfall to the Gulf of Mexico. This is the 201 Alternative which includes the Avondale, Pen Haven, Warrington, Northwest, Perdido Key and Southwest Escambia service areas with a combined flow of 7.7 mgd.

The present worth cost of this alternative is $64.8 million.

Alternative 2

This alternative provides centralized wastewater service with new treatment plants for the Southwest County and Perdido Key areas. The Southwest County treatment plant would have secondary treatment with discharge by land application. The capacity of this plant would be 0.54 mgd with 50 percent of the area's population served. The Perdido Key treatment plant would have secondary treatment with discharge by land application. Projected capacity is 1.7 mgd with 100 percent of the population sewered. The Warrington and Avondale treatment plants would be phased out with flows conveyed to the Main Street plant for treatment and disposal. Centralized sewer service would be provided to the Northwest area with conveyance to the Main Street plant for treatment and disposal.

The present worth cost of this alternative is $25.3 million.

Alternative 3

This alternative continues current wastewater management practices of use of package plants and septic tanks in Southwest County, Perdido Key and Northwest County. The Warrington and Avondale treatment plants would be phased out with flows conveyed to the Main Street plant for treatment and disposal.

The present worth cost of this alternative is $9.0 million.

2. Santa Rosa Island/Gulf Breeze Peninsula

Alternatives for Santa Rosa County address Santa Rosa Island and the Gulf Breeze Peninsula including the Gulf Breeze, Pensacola Beach and Navarre Beach service areas (See Figure II-2). The options considered range from regional to on-lot systems.

Alternative 1

This is the 201 Plan Alternative. A new regional plant would be constructed on the eastern end of the Gulf Breeze Peninsula with disposal by land application at the Eglin Air Force Base. Capacity of the plant would be 8.0 mgd with secondary treatment. The plant would treat flows from Gulf Breeze, Pensacola Beach and Navarre Beach.

The present worth cost of this alternative is $36.9 million.

Alternative 2

This alternative would convey flows from Pensacola Beach and Gulf Breeze to the Main Street plant for treatment and disposal. Flows from Navarre Beach would be treated at the existing treatment plant with land application.

The present worth cost of this alternative is $17.3 million.

Alternative 3

This alternative involves expansion of the Pensacola Beach plant to 2.4 mgd with the existing level of treatment and discharge point. Class 1 reliability will be provided. The existing plant at Navarre Beach would remain at its current capacity. The City of Gulf Breeze would continue treatment and disposal at the existing location with expansion from 0.5 to 0.8 mgd. The continued use of package plants and septic tanks is projected for the Gulf Breeze Peninsula.

The present worth cost of this alternative is $7.4 million.

Alternative 4

This alternative conveys flows from Pensacola Beach and Gulf Breeze to Pensacola Bay following treatment at Gulf Breeze. Flows from Navarre Beach would be treated at the existing plant with discharge by land application.

The present worth cost of this alternative is $10.8 million.

CHAPTER III. AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES AND MITIGATIVE MEASURES

A. Introduction

This chapter summarizes the existing natural and man-made environment of the study area, the environmental impacts of the alternatives and possible measures to mitigate these impacts. The information was compiled based on a literature search, interviews with local, state and federal officials, input from the EIS Review Committee and other concerned citizens, and field sampling and survey programs.

B. Existing Natural Environment

1. Freshwater Resources

Freshwater resources in the study area may be potentially impacted by the disposal of treated wastewater and by increased development, leading to alteration of existing drainage patterns. In a coastal area such as South Escambia and Santa Rosa Counties, freshwater resources also play an integral role in the estuarine systems and in the formation of environmentally sensitive floodplains and wetlands.

a. Hydrology

Freshwater hydrology in the study area is dominated by four major river basins that drain into the Perdido and Pensacola Bay systems. These are the Perdido, Escambia, Blackwater and Yellow River basins. Additionally, there is some localized, coastal drainage. This includes the East Bay River, draining into Escambia Bay, as well as overland flow from the Gulf Breeze Peninsula, Perdido Key, Garcon Peninsula, and the eastern portion of the Pensacola Peninsula.

Prior to entering Escambia and Santa Rosa Counties, the four river basins drain approximately 15,650 square kilometers (6,000 square miles) and bring an average of 287 cubic meters per second, cms (6.5 billion gallons per day, bgd) into the two counties. Within the counties, the streams accumulate an additional 73.9 cms (1.7 bgd) and 3,470 square kilometers (1,400 square miles) of drainage area. Coastal drainage and small stream flow into the bays account for an average of 9.64 cms (220 mgd).

The Perdido River forms the boundary between Florida and Alabama and drains into Perdido Bay. It has a total drainage area of 2396 square kilometers (925 square miles) and an average flow of 49.1 cms (1,120 mgd). It is the only major basin in the study area that does not drain into the Pensacola Bay system. The Escambia River basin has a total drainage area of 10,963 square kilometers (4,233 square miles) and an average flow of 198.9 cms (4,540 mgd). It drains into Escambia Bay and accounts for more than one-half of the stream flow into the Pensacola Bay system. The Blackwater River basin has a total of 2,227 square kilometers (860 square miles) and an average flow of 42.1 cms (960 mgd). It drains into Blackwater Bay and is the smallest of the four basins. The Yellow River basin has a total of 3,535 square kilometers (1,365 square miles) and an average flow of 71.0 cms (1,620 mgd).

It drains into East Bay and is the second largest river basin that drains into the bay system.

b. Quality

Recent trends indicate an enhancement in water quality of the rivers entering the Pensacola Bay system. However, substantial improvement will be required before all Class III water quality standards are met. This is especially true in the case of coliform bacterial counts, which must be substantially lowered to make these waters safe for water contact sports. General conclusions to be drawn from water quality data of the tributaries draining into the Pensacola Bay system are:

1. Dissolved oxygen levels meet or exceed state criteria at sampling stations throughout the freshwater drainage basin of the Pensacola Bay system.
2. Where comparisons are available, average nutrient values seem to have decreased substantially since the 1960's and 1970's. These decreases become less obvious as one moves down river. The values fall well within freshwater water quality screening criteria established by FDER for Class III waters in all tributaries into the Pensacola Bay system.
3. While concentrations of these nutrients are low, the loading of these parameters and other pollutants into the receiving estuarine environment causes concern. The build-up of these pollutants in the bottom muds of the system within the EIS study area can have long term, adverse impacts on estuarine water quality.
4. Violations of heavy metal criteria exist in stretches of the Escambia River and the Yellow River.
5. Violations of Class III water criteria continue to occur for total coliform bacteria in the Escambia River, Blackwater River and Yellow River, making these waters unsafe for contact sports.
6. There is a gradual decrease in macroinvertebrate community health moving downstream and accelerating as one approaches the estuarine environment. This is attributable to the stressful conditions of the interfacing fresh/saltwater environment as the river systems enter the estuaries, to pollution from increasing municipal and industrial discharges, and to concentrations of urban populations.

Water quality in the Perdido River shows trends improving in recent years relative to nutrient screening criteria developed by FDER for Class III waters. Bacterial violations and dissolved oxygen violations continue to exceed Class III criteria. Heavy metal violations have also been recently identified at the Barreneau Park station. Improved macroinvertebrate communities confirm improvements in water quality. An evaluation of the water quality of the Perdido River is presented below:

1. Historical (1960-70)/Recent (1978-79) Permanent Network Station Pollutant estimates, based on comparing the highest mean values from stations located between the confluence of the Perdido and Styx Rivers, indicate a major decrease in total phosphorus concentrations and nitrite/nitrate concentrations, of 0.51/0.13 mg/l-P (4.26/1.08 lb/mgal-P) and 0.33/0.17 mg/l-N (2.75/1.42 lb/mgal-N), respectively. Insufficient data exist to compare historical and recent water quality trends in TKN or total nitrogen concentrations.

2. In recent times (1978-79) both total phosphorus as P and total nitrogen as N show tendencies to meet Class III water quality criteria developed by FDER (1980).

3. At Barreneau Park, the only station sampled for heavy metals, cadmium, lead and mercury have periodically violated Class III criteria. What impact these pollutants might have on loading into Perdido Bay is unknown.

4. Dissolved oxygen violations continually occur in the Perdido River. It is not known if these are based on early morning or random samplings. If random, the frequency of violations would be expected to increase.

5. Total and fecal coliform counts continue to violate Class III criteria; however, trends over the last few years are not readily identifiable. High counts are attributed to agricultural runoff.

6. Macroinvertebrate diversity and indices imply improvement in community structures in recent years.

c. Ecology

The quality of the water and the abundance of general habitat types can be expected to determine the types of aquatic communities that exist in the study area. In general, the freshwater aquatic communities that exist in the Perdido River, Escambia River, Big Coldwater Creek, Blackwater River, Eleven Mile Creek, Eight Mile Creek, and Marcus Bayou Creek are in good condition. Some degradation from nonpoint source run-off and industrial and urban development has occurred, but the types of aquatic insects and fish found are fairly typical of blackwater systems (Ross and Jones 1979, Gunning pers. comm.).

All of the rivers and creeks in this study area can be termed as blackwater, caused from the abundant humic acids dissolved in the water from the surrounding swamps and bogs. In general, these blackwater systems are heterotrophic and dependent on transport of organic material from outside the system for production of fish and invertebrates to occur. Detrital input to these systems is essential, and these freshwater systems have detritus based food chains.

The freshwater subhabitats include sand sediment, mud sediment, submerged snag habitat, submerged aquatic vegetation, rock/gravel, depositional litter, and open water. The sand sediment, snag habitat, and submerged aquatic plants are the dominant habitat types in blackwater rivers and streams of this area.

2. Estuarine Resources

The estuarine resources of the South Escambia and Santa Rosa Counties study area constitute a complex system impacted by freshwater inflow, non-point runoff, and tidal currents. The area's estuaries play an important role in the life-cycle of many aquatic and terrestrial organisms and are also an important component of the area's recreation and tourist industries. Since the area's estuaries are also used for wastewater discharges and proposed alternatives may result in increased or relocated discharges, a thorough analysis of the estuarine resources is a necessary basis for the evaluation of existing and potential impacts.

a. Hydrodynamics

Circulation in the estuaries of Escambia and Santa Rosa Counties depends on numerous factors including river flow, tides, and wind. The circulation patterns of the Perdido and Pensacola Bay systems vary from two-layer flow with stratification to two-layer flow with vertical mixing (USEPA 1975, 201 Supplement 1978). The mean water transport in these bays is in a seaward direction for the upper layer and riverward in the lower layer. Under most conditions these systems show stratification, with little if any mixing. The result is that the flushing rate for these estuarine bays can be extremely low (200 days when river inflow is at ten-year low of 61 m^3/sec) (USEPA 1975). Local wind patterns can cause a current reversal to occur in these bays causing the upper layer to flow riverward and the lower layer seaward. The result of these reversals is that pollution sources are trapped in the estuaries for longer periods of time.

The tidal energy in the estuaries of these two counties is also relatively weak because of the low mean tidal range of 0.5 meters (1.5 feet). In addition, these tides are diurnal (one tidal cycle per day). The tidal cycle occurs approximately every two weeks from 0.8 meters (2.5 feet) during tropic tides, to 0.2 meters (0.5 feet) during equatorial tides (USEPA 1975). This low tidal range also serves to reinforce the weak circulation patterns.

The low flushing rate of these estuaries under normal conditions can lead to degraded water quality conditions. The low flushing rates also limit the amount of industrial and wastewater effluent that can be assimilated (USEPA 1975). Estuaries of this type tend to exhibit water quality problems and degraded biological communities. Further, weak circulation patterns lead to concentration of pollutants in sediments due to settling (USEPA 1975).

b. Quality

Even with great expenditures of funds to control point source pollution in the early 1970's, water quality in the Pensacola Bay system, though showing some improvement, is far from pristine. Nutrient concentrations continue to exceed established water quality screening criteria and, in some instances, show signs of increasing. The Pensacola Bay system remains in excess of its assimilative capacity for these nutrients. Dissolved oxygen concentrations in bottom waters continue to violate Florida water quality criteria of 4.0 mg/l (33.4 lb/mgal) during the saline-stratified conditions of the summer and early fall. This is attributed primarily to the residual effects from the buildup of organic materials in the bottom muds that require oxygen upon their decomposition. Secondary impacts from anaerobic conditions in the bottom waters may include the increased release of nutrients into the water column, stressed conditions for macroinvertebrate and dimersal (bottom) fish populations, and the buildup of toxic hydrogen sulfide in bottom muds.

Toxic substances, such as PCBs, pesticides and heavy metals, appear to be stored in sufficient quantity in the bottom muds to bioaccumulate and possibly result in lethal or sublethal effects on organisms. Additional research is needed in this area. A recent study in upper Escambia Bay indicates, however, a return of some pollution intolerant organisms. Additionally, the number of reported fish kills and the number of fish deaths per kill are well below the early 1970's figures. Since this is only the number of reported fish kills, caution must be used in interpreting this information. Perhaps the most dramatic indication of water quality is seen in commercial shrimp landings. Because of the economic infeasibility of fishing in bay waters, most larger concerns are converting over to ocean-going vessels. Bay boats, with increasing frequency, are having to travel outside of the Pensacola Bay system in order to catch economical yields of shrimp. Oysters have not been in sufficient quantities to commercially harvest since the early 1970's.

Current water quality in Perdido Bay remains about the same as it was in the early 1970's. Based on limited information, no major trends were identified that indicated violations of water quality criteria. Macroinvertebrate community diversity is low for a Florida estuary and, most importantly, commercial shrimp landings have not been recorded for this area since 1975. Most of the total nitrogen and BOD_5 loading into Perdido Bay enters via the Perdido River and originates from point and nonpoint source pollution. Most of the total phosphorus loading into Perdido Bay originates from point sources within the immediate drainage areas of the bay.

In an attempt to compare the contribution of pollution from point and nonpoint sources, average calculated land use-related nonpoint source pollutant loadings and average point source NPDES loading limitations from 1975 were compared to in situ loading estimates calibrated from average historical (1960-70) and recent (1978-79) water quality data and stream flows maintained by FDER and the USGS, respectively. FDER Permanent Network Station water quality data for 1978-79 and 1960-70 and average USGS stream flows were taken from the 305b Report (FDER 1980). This water quality data compares statistically, (t-test for group comparison, 95 percent level of confidence) with recent values collected by consultants (CH_2M/Hill C1980) in the mouth of the Escambia River. Based upon this statistical relationship, it is assumed that water quality data abstracted from the FDER (1980) 305b report is sufficiently representative of current water quality from tributaries entering the Pensacola Bay system to determine recent loading estimates.

Water quality data for the Escambia River and water quality data, as well as stream flow data, for the Blackwater and Yellow Rivers were estimated from the 305b Report for monitoring stations located within 48-65 kilometers (30-40 miles) of the river mouths. Average flows for Escambia River, both in historical and recent times, were based on USGS stream gauging stations at Century, Florida. These were adjusted to account for the average contribution from the downstream portion of the watershed.

c. Ecology

Estuaries are complex ecosystems and are extremely difficult to characterize. These areas are naturally enriched from the transport of organics from adjacent terrestrial areas, natural nutrient recycling in component estuarine subsystems, and transport of nutrient material from the freshwater rivers. These ecosystems are extremely important to the marine shellfish and finfish because they provide not only a great abundance of food but also a breeding and nursery ground for many of the commercially important species.

The type of estuarine communities found in the Escambia-Santa Rosa County EIS study area are dependent mostly on water quality and the general abundance of habitat types. The communities that exist in the estuaries of Perdido Bay, Pensacola Bay, East Bay, and Escambia Bay indicate a wide range in physical and environmental conditions. Numerous factors (e.g., salinity, toxic wastes, and point and nonpoint pollution sources) determine the quality and type of community that can be found in estuaries. The estuaries in the EIS study area are represented by communities which are in an intermediate stage between natural undisturbed systems and those that are polluted, which show the characteristic degradation in normal production of shellfish and finfish.

3. Marine Resources

The hydrodynamics, water quality and ecology of the Gulf waters are related to the estuarine resources and have an important bearing on the proposed Gulf outfall. For these reasons, a thorough analysis of the study area's marine resources is essential for the complete evaluation of potential environmental impacts.

a. Hydrodynamics

Marine hydrodynamics are represented by a complex network of current loop patterns which are in a state of constant change due to numerous factors (Smith 1974). The main loop currents located in the offshore area of Escambia and Santa Rosa Counties are the Mississippi-Alabama Shelf Loop, the West Florida Loop, and the Gulf Loop. Each of these current loop patterns will either reinforce the others or create a zone of transition with little or no movement (Smith 1974, Jones et al 1973). The West Florida Loop and the Mississippi-Alabama Loop are responsible for the longshore drift in a westerly direction along the barrier islands of Escambia and Santa Rosa Counties (Jones et al. 1973). In the area where these two current loops meet, an eddy loop is created since these loops are in direct opposition (Mississippi-Alabama current inshore and West Florida current offshore) to each other. This relationship and resulting transition zone and eddy current change during the year. In the deeper offshore Gulf area, the Gulf Current Loop operates and serves to reinforce these nearshore current patterns. This offshore Gulf Loop also exhibits seasonal characteristics.

Major factors that can change the normal patterns include the tropical storms and hurricanes that frequent this area of the Gulf. The tidal surge from these storms causes massive amounts of water to build up along the coast, and normal water circulation patterns are altered. The tides are another factor in the movement of water and are diurnal in nature (Smith 1974). This means that, typically, one high and one low tide occur per day. Tides in the Escambia-Santa Rosa County area have a mean of only 0.3 meters (1.1 feet) (USEPA 1975). The tides along with the Gulf Loop are probably responsible for the upwellings along the shelf area. While the tides are small in this area of the Gulf, during the time of tropical storm activity the tides and tidal surge will change the nearshore sediment zones and thus change current patterns.

b. Quality

Significant data gaps exist in our understanding of the current state of water quality of the Gulf of Mexico adjacent to the study area. The most comprehensive study took place in August and September 1971. This study, conducted by Florida State University and the Florida Coastal Coordination Council, provides most of the available information for this region. The main thrusts of the investigations were to determine the levels of pollutant occurrence within the Gulf and bay systems and to determine the sources of origin.

The results of the marine investigation indicate that tidal discharges from the study area bay systems are influencing the surface territorial waters south of the entrance to Pensacola Bay to a certain degree. The results of analyses from investigations of trace element distribution, pesticide distribution, sedimentary parameters and wind/water dynamics, however, have led to the conclusion that the principal measured effects in the Florida territorial sea off the study area coast are the result of a major influence outside the study area and to the west. The most likely source is considered to be Mobile Bay. Additional contributions appear to be from the Mississippi River delta and the Perdido and Escambia River systems.

c. Ecology

The type of marine communities that can be expected offshore Escambia and Santa Rosa Counties are dependent mostly on the sediment type, season, and general water quality. In general, offshore marine systems are more diverse, in terms of invertebrate and fish species, than the estuarine systems. However, while species diversity is high, the relative abundance (number/m^2) is lower than that of estuarine systems. This general diversity/abundance relationship is true for the soft sediment offshore areas, but where reef communities occur, diversity, abundance, and productivity are all high.

For the purpose of this report, the marine environment is divided into four zones:

The nearshore benthic community consists of numerous species of burrowing invertebrates and associated bottom feeding fishes. Small areas of reefs are located on patches of limestone outcroppings. These nearshore sediment areas are important to the local finfish and shellfish.

The nearshore waters consist of a plankton-based community and associated plankton-feeding fish. Phytoplankton consist of a few species of diatoms and dinoflagellates. These organisms are preyed upon by small crustacean groups, which are in turn preyed upon by commercially important fishes.

The offshore sediment zone has extensive areas of reef development. These areas are rich in invertebrate and fish communities. While soft sediment areas are dominated by burrowing species, reef areas are dominated by sessile species. These are supporting many commercially important finfish.

The offshore waters are dominated by pelagic fish species which are commercially important. Many of the nearshore plankton and fish species can also be found in this area. The plankton-based food chain in the open waters is not as extensive as that of nearshore plankton systems due to nutrient limitations.

d. Topography/Geology/Sediments

The area offshore of Santa Rosa and Escambia Counties is known as the Mississippi-Alabama shelf. It is a flat topographic feature except for the relief associated with the shelf edge and upper continental slope. The shelf extends some 100 kilometers (62.1 mi) offshore, and reaches depths of almost 60 meters (197 feet). South of Pensacola Bay, the Mississippi-Alabama shelf pinches in to form the head of the DeSoto Canyon. The canyon has very steep slopes, similar to those of a deeply incised river. Erosion of the eastern side and deposition on the western side have slowly shifted the canyon eastward. The ocean floor off Perdido Key is 10 m (33 ft) deep at a distance of 2500 to 3000 m (8200 to 9840 ft) from shore, whereas this depth is reached only 650 to 950 m (2,130 to 3,120 ft) offshore from Santa Rosa Island. The slope then becomes more gentle off Santa Rosa Island and 20 m (66 ft) depths are found 2500 to 4500 m (8,200 to 14,765 ft) offshore. The estuaries along the Gulf are drowned mouths of river valleys, and hence have the same general geomorphology. They are broad, U-shaped valleys which would, if sea level were lower, resemble existing river valleys in the area.

The geologic origin of the Gulf of Mexico is uncertain, and the depth to the base of the carbonate platform is unknown. A marked stratigraphic discontinuity is found at the DeSoto Canyon. It is here, offshore from Pensacola, that the carbonate sedimentary province of the Florida Platform (west of the Florida Peninsula) gives way to the clastic deposits of the northern Gulf Coast. Beneath the unconsolidated marine sediments lie limestones, dolomites and shales similar to the formations seen in onshore wells. A major geologic difference is that the Mississippi Interior Salt Dome Basin extends into western Florida. Salt domes are geologically stable and have been explored primarily for the oil with which they are often associated.

The Mississippi-Alabama shelf is overlain by terrigenous sediments containing less than 30 percent $CaCO_3$. They are primarily sand, silty sand, sandy silt, and sand-silt-clay, collectively known as the Mississippi-Alabama sand facies. Facies are a part of a rock body different from other parts by appearance or composition. Generally, sediments west of the DeSoto Canyon consist of finer-grained silt, clayey silt, silty clay and clay, while east of the Canyon, calcareous sands containing shells, algae, coral and oolites may be found. The calcareous reef facies becomes a narrow shelf edge reef facies. The DeSoto Canyon sediments are primarily globigerina, or petropod ooze, and calcareous silts and clays.

Because the sediments are primarily derived from the continental land mass, there are few limestone facies present. The rivers emptying into the Gulf from the Pensacola area generally do not carry many sediments. River gradients are low, and velocity of the waters is too low to carry large particle sizes. The largest particles that make it to the Gulf are sand sized. These are dropped once the rivers enter the Gulf. Smaller particles are carried even further out until they, too, are deposited by slow-moving currents.

4. Groundwater Resources

The two major aquifers in the study area are the Floridan aquifer, which is found at depths that generally exceed 300 meters (1,000 feet), and the shallower sand-and-gravel aquifer. The sand-and-gravel aquifer is near the surface and contains a large quantity of freshwater. It is for these reasons that most of the water supply wells are drilled into the upper aquifer. As a result, most of the available water quality data are for this aquifer.

The Floridan aquifer within the study area is composed of porous and permeable coquina (limestone). Water from the aquifer could serve many water supply purposes; however, concentrations of certain constituents have sometimes exceeded desirable limits for certain specific uses. Dissolved solids in the upper limestone of the Floridan aquifer typically range from 500 to over 1,000 mg/l (4,172 to over 8,345 lb/mgal) in the study area. In portions of northwest Florida, values as high as 4,000 mg/l (33,380 lb/mgal) have been recorded in coastal areas. In southern Escambia County, chloride values have exceeded 1,000 mg/l (8,345 lb/mgal). Fluoride values exceeding 0.6 mg/l (5.6 lb/mgal) have been recorded in the southern half of Escambia and Santa Rosa Counties.

In the sand-and-gravel aquifer, the dissolved solids concentrations are generally low since there is relatively little soluble material in the sands and gravels. The groundwater is, however, more mineralized than surface waters since it remains in contact with rocks and soils for much longer periods. The water from this aquifer contains dissolved carbon dioxide that originates primarily from the decay of soil organic matter, as well as from the atmosphere. The dissolved carbon dioxide forms carbonic acid that encounters little buffering action and has strong corrosive effects. This corrosion is further enhanced by the generally low iron content of the water, which is 0.06 to 4.9 mg/l (0.50 to 40.9 lb/mgal).

Hydrogen sulfide in the sand-and-gravel aquifer is present in trace amounts in South Escambia and Santa Rosa Counties. The prime source of hydrogen sulfide here is decaying organic material buried in the aquifer. The low concentration has not been detected by chemical analyses, but rather by its characteristic odor. Well water samples taken from wells located near the bays show the presence of sodium and chloride. Salt water intrusion into this portion of the aquifer could be due to excessive pumping by the wells.

Water levels in wells range from below sea level in the area from the Naval Air Station to downtown Pensacola to approximately 80 feet above sea level near the junction of S-196 and S-95A. Water levels below sea level are caused by excessive pumping from large capacity wells. Where several heavily pumped wells are close together, the cones of depression coalesce and lower the water below sea level. Many perched water tables are located within the study area. Currently, some private wells are used for water supply on the barrier islands but as development infringes on areas served by private wells, property owners are required to connect to the public water supplies available on both Perdido Key and Santa Rosa Island.

The natural direction of groundwater movement in the study area is away from the topographic highs towards low lying rivers and bays. Groundwater movement is generally rapid through the sandy soils, its rate being determined by the soil porosity and permeability. The static water level in the aquifer slopes generally from north to south, indicating that the water discharge pattern is the Gulf of Mexico.

5. Terrestrial Systems

A complete inventory of land-based resources is critical to the evaluation of wastewater management impacts. Impacts to terrestrial systems may result from several factors including the implementation of land application systems or increased development induced through the provision or expansion of wastewater facilities.

a. Ecology

South Escambia and Santa Rosa Counties contain a wide variety of terrestrial plant and animal species. However, the terrestrial ecology of the study area is best understood in terms of the existing vegetation patterns. Vegetation communities are not only highly visible but are relatively stable and largely determine the occurrence of wildlife populations. Eight vegetation communities occur in South Escambia and Santa Rosa Counties.

Comprehensive species lists of woody and herbaceous plants for all of the local community types may be found in the 201 Facilities Plan (1978). This report may also be referred to for more complete lists and scientific names of amphibians, reptiles, mammals, and birds known from the study area. Other important references describing the terrestrial ecology of the study area include works by the Florida Department of Natural Resources (DNR 1975), Hartman (1978), Monk (1965, 1968), and the National Park Service (NPS 1976, 1978).

b. Protected Species

The study area region is known to contain as many as 44 species of protected animals. The most important terrestrial habitats for protected animals are wetlands (salt marshes, freshwater marshes, and swamps) and the coastal dune/beach community. All of the aquatic habitats (freshwater streams, estuaries, and marine waters) are important habitats for protected animals, but estuaries are particularly valuable. Recently, the Perdido Key beach mouse has been proposed for inclusion on the federal list of endangered species along with the designation of critical habitat in Escambia County, Florida, and Baldwin County, Alabama.

Protected plants are covered by state laws only. A conservative estimate totals at least 50 protected plant species for the study area. Swamps, hardwood hammocks, and wet pine platwoods are the most important habitats.

6. Sensitive Areas

Sensitive areas are environmental features which warrant particular consideration for reasons such as uniqueness, rarity, hazardous conditions, high ecological value, and low tolerance to perturbations. Sensitive areas which are especially important to this study area include barrier islands, estuaries, off-shore marine reefs, wetlands, hardwood hammocks, habitats for protected species, floodplains, and groundwater recharge areas.

A critical issue considered by this study is the possibility of induced development on barrier islands resulting from the extension of wastewater treatment services to these areas. Barrier islands are sensitive to development for a number of reasons: extreme vulnerability to storms with their associated high winds and floodwaters; continual erosion and accretion processes along island shorelines; and the presence of other sensitive features such as wetlands, protected species habitats, and historic sites. Additionally, barrier islands form an important protective zone by shielding estuaries and mainland shores from the effects of storm events and normal erosional processes.

Estuaries are considered sensitive because of the ecological importance and vulnerability of this ecosystem. The high biological productivity of estuaries make these systems valuable to terrestrial and marine wildlife for food sources, breeding areas and nursery grounds. The vulnerability of these estuaries to water pollution is increased by natural stresses resulting from the mixing of salt waters and fresh waters and the presence of Class III waters and aquatic preserves. Of particular concern within the estuarine ecosystem are the communities of submerged seagrass beds, oyster beds, and salt marshes; these habitats are extremely high in ecological value, invaluable to local fisheries, and vulnerable to perturbations such as dredging, filling, pollution and siltation.

Offshore marine reefs are extremely productive and provide habitats for many commercial fish species. Reef communities are extensive in the shallow submerged shelf areas of the Gulf of Mexico within 25 miles of the study area. However, accurate mapping of reefs near the study area does not currently exist. Marine reefs are potentially vulnerable to impacts from near-shore water quality problems, offshore oil drilling operations, and marine outfall disposal of wastewater effluents.

Wetlands are considered sensitive areas because of their high ecological value and indirect economic importance. Some of the more valuable functions of wetlands include: high biological productivity; providing food, habitat, and reproductive areas for many animal and plant species; maintaining natural drainage characteristics, sedimentation patterns, salinity distributions, and other hydrologic functions; shielding land areas from wave action, erosion, and storm damage; providing storage areas for storm and flood waters; and purifying water through natural filtration processes.

Many plant community types found within the study area are considered wetlands: swamps, wet pine flatwoods, freshwater marshes, salt marshes, and submerged grassbeds. Although originally the climax vegetation on upland sites in north Florida, hardwood hammocks are currently limited in extent within the study area. Hammocks are valuable habitats for many plants and wildlife, including a number of protected species.

Habitats for protected species are considered especially sensitive to impacts although such areas are included within many of the previously discussed sensitive features. This vulnerability to impacts is due to the large number of protected species known from the study area region (at least 44 animal species and 50 plant species) and the widespread occurrence of potential habitat conditions. Protected species are regulated by federal and state laws, the most important of which are the federal Endangered Species Act of 1973, and the state Rules Relating to Endangered and Threatened Species and the Preservation of Native Flora of Florida Act.

Groundwater is a major resource to the Pensacola area, as most drinking water supplies are derived from groundwater. To maintain the viability of aquifers, major aquifer recharge areas must be protected. As development occurs, the natural hydrologic cycle is disturbed. Water which would have percolated into the aquifer instead enters streams and other receiving water bodies due to increased impervious areas associated with development, which increases runoff and decreases percolation. This decreases the amount of water available for drinking water supplies. Therefore, major recharge areas are considered sensitive and in need of protection.

The 100-year floodplain is considered a sensitive area from the standpoint of vulnerability to flooding. It includes that area which would be flooded by a storm with a 100-year return period, which means, statistically, likely to occur once in 100 years. However, such a storm could occur two years in a row since it is based on long-term statistics. Development of such areas is considered undesirable due to the flood potential. Furthermore, many of the sensitive wetland areas occur within the 100-year floodplain.

7. Physiography

Information about topography, geology, and soils of the area is important in establishing wastewater management alternatives. The terrain and slope of land affects pumping of sewage and potential land application and on-lot sites. Surface and subsurface geology also affects the placement of interceptors, groundwater resources, deep-well injection potential, land application, and on-site systems. Of most importance to the latter two are soils. Characteristics such as permeability, porosity, grain size, and organic content all have effects on the applicability of certain wastewater treatment/disposal systems.

a. Topography/Geology

The study area lies within the Gulf Coastal Lowlands of the Coastal Plain physiographic province. These relatively undissected, level plains usually lie less than 30 meters (100 feet) above mean sea level. The peninsula areas, the Escambia River Valley and the barrier islands are all parts of the

Lowlands. North of the Lowlands, and the study area, are the Western Highlands. This is a southward sloping plateau into which a number of streams have incised valleys. While the study area is generally flat, there are isolated areas of short and steep slopes. Those which are not due to the formation of marine terraces are naturally-occurring streambanks cut into the terrace sediments. They are found primarily around Elevenmile Creek, Marcus Bayou, the Perdido River and the Escambia River.

The barrier islands are most noticeable features, recent geological deposits of sand that are formed and changed by wave energy, nearshore currents and sand supply. During the summer, beaches gradually widen and become steeper. During the winter and in large summer storms, larger, more closely spaced waves and a strong backwash remove sand from the beach to form bars slightly offshore and a narrow, flatter beach profile results. This simple pattern is complicated by variations in wave direction, tides, and length and intensity of storms. Beaches are usually found in some sort of temporary equilibrium. In addition to the sand movement perpendicular to the water line, sand also moves parallel to the water line by a process known as littoral drift. This can usually be seen in the formation of hook-shaped spits at the downdrift ends of the barrier islands. In the study area, littoral drift is primarily from east to west.

Santa Rosa Island is about 80 kilometers (50 miles) long and less than 0.80 kilometer (0.50 mile) wide in most places. It has a fairly continuous dune ridge along its entire length that is much more extensive on the eastern one-fifth of the island. It experiences a local washover during heavy storms. The island has a relatively steep foreshore slope of nine to ten degrees. Perdido Key is shorter than Santa Rosa Island and is almost connected to the mainland by a small marshy area behind Gulf Beach through which the Intracoastal Waterway is dredged. The Key is similar to Santa Rosa Island in its dune line and slope.

b. Soils

In the upland regions of the study area, soils developed from thick beds of unconsolidated acid sands and clay parent materials. Many different soils developed in this region due to topographic factors and diverse kinds of parent material. The Gulf Coastal Lowland sections of the study area are characterized predominantly by moderately well-drained to very poorly drained soils, with high groundwater tables. Poor drainage characteristics associated with soils, particularly in the southwest part of Escambia County, seriously limit both agricultural and urban uses of these soils. Presently, large parcels support scattered long leaf and slash pines and undergrowth of various water-tolerant herbs and grasses.

The Environmental Inventory Task Report describes the general soils associations occurring in and adjacent to the study area portions of Escambia and Santa Rosa Counties. These associations represent groups of defined and named taxonomic soil units occurring together in an individual and characteristic pattern.

8. Air Resources

Air resources are described by four components: climate, air quality, odor, and noise. For the analysis of wastewater management alternatives, climate is the most important. Odor serves primarily as an indicator of problems with existing facilities and can impact alternatives development. Odor complaints in the Pensacola area are received infrequently and are not considered a problem by Florida DER. Air quality and noise levels are currently acceptable, although the air quality standard for ozone was nearly reached in 1980. Neither air quality nor noise is affected by primary impacts of wastewater management, but both can be affected by secondary impacts.

The climate of the Pensacola area places few restrictions on alternatives. Freezing, which can be a major problem affecting the type and efficiency of sewage treatment and disposal, is not a problem for this area. Precipitation patterns are also important. In this regard, thunderstorm activity and periodic heavy rains must be considered in the development of alternatives. High winds, rain, and storm surges resulting from hurricane activity must also be taken into account.

In the Pensacola area, climatological data have been collected since 1879. The National Oceanic and Atmospheric Administration (1979) has summarized the climate as follows:

> Pensacola's nearness to the Gulf of Mexico, about six miles distant, gives it the full benefit of the moderating effect of that body of water, tempering the cold "Northers" of winter and causing cool sea breezes during the daytime in summer.
>
> Records indicate the average temperature for the summer months (June, July, and August) is 27.0°C (80.7°F), with an average daily range of 6.9°C (12.5°F). Temperatures of 32.2°C (90°F) or higher occur on the average of 39 times yearly, but a temperature of 37.7°C (100°F) or higher has been recorded only 11 times. The average winter temperature, considering the months of December, January, and February, is 12.4°C (54.3°F) with an average daily range of 8.7°C (15.7°F). On the average, the temperature goes to freezing or below on but nine days of the year. The average date of last freezing temperature in spring is February 20, and the average date of earliest in autumn is December 9, making the average growing season 292 days. Severe cold waves are rather infrequent.
>
> Rainfall is usually well distributed through the year, and on the average, measurable amounts occur on 112 days annually, the greatest frequency normally being in July and August. The monthly rainfall average is greatest in July and least in October. A considerable part of the rainfall in summer occurs during the daylight hours, comes in the form of thundershowers, and is often excessive, while the rains of winter are more often less heavy but extend over longer periods. Snow has occurred in 28 of 84 years of record, but there have been only eight years of measurable amounts.

March is the windiest month of the year on the basis of average hourly velocity, while August has the lowest average wind velocity of any month. A moderate sea breeze usually blows off the Gulf of Mexico during most of the day in summer. There is an average of 343 days during the year in which sunshine occurs.

C. Existing Man-Made Environment

1. Land Use

Present and future land use patterns are primary factors in wastewater management planning. Present land use analyses are necessary to identify current wastewater treatment problems and indicate the type and location of treatment and disposal facilities required. Future land use projections based on current trends and land suitability are necessary to accurately develop and evaluate proposed wastewater management alternatives.

a. Present Land Use

Escambia and Santa Rosa Counties contain approximately 1,215,167 acres. The portion of the two counties involved in the study area encompasses approximately 160,000 acres of land (both mainland and coastal islands).

The majority of developed land within the study area is located within the city of Pensacola and adjacent areas of Escambia County. Of the 57,129 acres of developed land, Pensacola contains 20.4 percent (11,654 ac.), Escambia County 69.3 percent (39,590 ac.), and Santa Rosa County 10.3 percent (5,884 ac.). Pensacola is 76 percent developed whereas Escambia County is only 53 percent developed.

Approximately one-third of the area of Escambia County within the study area is in residential use. Most residential development is at a density of more than two dwelling units per acre and the general concentrations occur northwest and southwest of the city. The existing pattern is the result of sprawl in a westerly direction from the city. Pockets of open space are located throughout the area, which indicate that development "leap-frogged" due to natural or economic constraints such as wetlands or land marketability.

Commercial uses are concentrated in the central business district of the city and along major thoroughfares leading to the suburbs. Commercial development accounts for 9 percent of the area of the city and only 3 percent of Escambia County. However, total commercial acreage is greater in the county.

Industrial activity is not a dominant factor in the study area and represents only 2 percent of the developed land within the city and within the county. Most of the industrial operations within the study area are older, light-to-medium industries. The newer operations have located outside the study area generally north of Escambia and Blackwater Bays.

Public/semi-public uses represent 16 percent of Escambia County. The Pensacola Naval Air Station occupies approximately 5000 acres of land along Pensacola Bay. Fort Pickens represents about 1300 acres on the western-most part of Santa Rosa Island. These areas are dominant features of the study area and preclude future development unless otherwise changed.

The majority of undeveloped land in Escambia County is categorized as vacant/forested. From an environmental standpoint, the northwest portion of the county is considered the most appropriate for development due to large areas of forest. In contrast, the southwest portion is largely wetlands and uplands and is environmentally not preferred for development.

The Santa Rosa Island Authority was created as an agency of Escambia County through an act of the state legislature in June 1947. The act gave the Authority general powers to develop and improve Santa Rosa Island for beach, resort, and recreational purposes. The portion of the island known as Pensacola Beach has been developed by this Authority. Most of the land in Pensacola Beach is already developed or is committed to development by lease agreements. The Authority, however, retains control of approximately 40 percent of the available vacant land in dune preservation areas or unleased lots.

In February 1956, the Authority entered into an agreement with the Santa Rosa County Board of Commissioners wherein the Authority agreed to lease to Santa Rosa County four miles of the island, located in the east end of the island property at or near Navarre, Florida. This portion of the island has been named Navarre Beach and is being developed under the management of the Navarre Beach Advisory Council (formerly the Santa Rosa County Beach Administration). The development of Navarre Beach was slow for many years with activity increasing recently. Approximately three fourths of the total land in the Navarre Beach jurisdiction is presently undeveloped.

Of the 76,704 total land acres of Santa Rosa County in the study area, approximately 43,100 acres are dedicated to the Eglin Air Force Base/Eglin Reserve. This represents a large amount of land which cannot be considered as having development potential. Additionally, 11,235 acres of water and wetland areas are classified as "No-Build". The remaining area of the county in the study area which is developed or buildable equals about 21,322 acres (27.8 percent).

The major node of developed land in the Santa Rosa County portion of the study area occurs in and around the city of Gulf Breeze. The primary land use in this area is single-family residential. As of January 1, 1977, there were approximately 1,760 single-family residences, three apartment complexes with a combined total of 272 units, and two motels with a combined total of 205 units. The city contains a small medical clinic and three public schools serving a large portion of the Gulf Breeze Peninsula. Only minor commercial activities occur along major thoroughfares due to the city's proximity to the city of Pensacola.

Approximately 70 percent of the Gulf Breeze Peninsula is currently undeveloped but is experiencing growth along the Bay and Santa Rosa Sound. The area is attractive due to its relative calmness caused by the Santa Rosa Barrier Island. The area contiguous to the Eglin Reserve is predominately wetlands and will not likely be developed.

b. Future Land Use

Future growth and development within the study area will generally occur adjacent to existing development. Escambia County is not expected to register as large a decrease in percentage undeveloped as is Pensacola, but the 8 percent decrease from 50 percent to 42 percent represents a total of 5,000 acres which will become developed. The greatest acreage expected to develop will also be the less than two dwelling units per acre category. The land use plan shows this growth occurring in the northwest segment of the study area where sparse development makes available the most accessible land. Commercial uses will likely expand along major thoroughfares.

Based on the amount of undeveloped land in the city of Pensacola in 1981 (24 percent), undeveloped acreage is projected to decrease to 6 percent by 1996. The largest change is anticipated in the residential category, less than two dwelling units per acre, which will increase from 528 acres (3 percent of total) in 1981 to 2160 acres (14 percent of total) by 1996. This increase will occur by in-filling the vacant areas outside the central business district as well as redevelopment of existing areas. Also, transportation/utilities/communications will experience a 700-acre (5 percent) increase over the same period.

Development in Southwest Escambia County, including Perdido Key, is also likely to increase based on current trends. The 208 population projections indicate less development will occur in this area due to the presence of floodplains, wetlands and other environmentally sensitive areas. In practice, this requires local land use planning that has only recently addressed this problem at all. Based on current trends, development in these coastal areas will continue at a rapid pace with few controls.

Santa Rosa Island will remain virtually the same as in 1981 with the exception of residential and commercial development around Pensacola Beach. Much of the island is not available for development because of public ownership or environmental constraints. The area around Navarre Beach is also expected to experience some development.

Santa Rosa County, large portions of which are dedicated to military use, has 14,000 acres of undeveloped yet buildable land within the study area. While growth is expected to continue near Gulf Breeze, limited access to commercial and employment opportunities of the region could hamper large-scale development of this area. The portion of Santa Rosa County in the study area is not expected to experience significant growth by 1996. The land use pattern will continue to be dispersed residential use on the peninsula with Gulf Breeze retaining its nodal characteristics for that area.

2. Development Controls

Laws, ordinances, and regulations at the federal, state and local levels place numerous restrictions on the use of the natural environment in the study area. These restrictions effectively limit development in certain areas and have a dramatic impact on the pattern and density of development. Regulations concerning wastewater treatment are particularly important determinants of land use patterns and density. The State of Florida has been particularly progressive in terms of environmental protection. State laws in

Florida protect a variety of environmentally sensitive areas including submerged lands, beaches, wetlands, and coastal waters. Florida is one of the few states to mandate local planning and require local comprehensive plans. The State has also established Areas of Critical State Concern and identified Developments of Regional Impact in order to minimize potential adverse impacts of large-scale development. State regulations also control the use of septic tanks and establish standards for wastewater treatment and disposal. In most cases state regulations are more stringent than federal regulations.

a. Land Use Regulations

Numerous legal devices are used by municipal and county governments to assure that land development and construction practices consider the health, safety, and welfare of all citizens. Many local control measures are instituted in response to state and federal initiatives that provide policy direction and financial assistance to participating local governments. An example of this type of control is the Coastal Zone Management Program. Other locally instituted resource management measures seek to encourage the expansion of the local economy in a wise and practical manner through such mechanisms as floodplain regulations and the designation of historic districts.

Table III-1 shows a matrix of land use management techniques currently in use by the local governments and authorities in the study area. These local regulations and ordinances provide the major conservation mechanisms for resource protection in Escambia and Santa Rosa Counties. These protective measures have been legislated at the various levels of government because of the realization that long term economic development is directly dependent on the conservation of natural resources. These resources must be conserved to assure that the natural functions they serve, on which man is dependent, will continue to provide a sound economic base for future development in the EIS study area.

An ordinance establishing zoning regulations on Perdido Key was passed by the Board of County Commissioners on July 21, 1983. The declared purpose and intent of the ordinance, as stated in Article IV, is to implement the Perdido Key Land and Resource Management Plan, a subelement of the Escambia County Comprehensive Plan. Article IV sets forth the objective of maintaining, restoring and enhancing the environmental quality of the island and recognizes the unique characteristics of barrier islands and their vulnerability to hurricanes and storm surges. It is significant to note, however, that this ordinance will allow the locally projected population to increase from 3,432 to 36,710. The ordinance itself provides some tools to help accomplish this, but other tools such as building codes are equally important but absent. The Santa Rosa Island Authority, for example, has instituted strict building codes to help offset the effects of hurricanes and other wind-driven storms.

The island has been divided into three residential, one outdoor recreation and one commercial district. Residential districts are basically defined in terms of development density, i.e., the permitted number of dwelling units (DU) per acre:

Table III-1. Land Management Mechanisms in the EIS Study Area.

	Escambia Co.	Pensacola	Santa Rosa Is. Authority	Santa Rosa County	Gulf Breeze
Zoning Ordinances	X(1)	X	X		X
P.U.D. Provisions		X	X		
Buffer Zone Requirements					X
Landscape Ordinance			X		X
Site Plan Review Process	X	X	X	X	X
Flood Plain Process	X	X	X	X	X
Subdivisions Regulations	X	X	X	X	X
Sedimentation Erosion Control Ordinance	X	X	X		X
Tree Ordinance		X			X
Airport Zoning Ordinance		X		X	
Estuarine/ Wetland Set Back Ordinance			X		
Historical Preservation		X			

(1) Perdido Key

District	Density	DU/Acre	Building Height	Maximum Lot Coverage
R-1	Low	0-4	2.5 stories or 35 ft	N/A
R-2	Medium	5-8	N/A	19-25%
R-3	High	9-14	N/A	19-25%

Within the above constraints, multi-family dwellings may contain any number of stories. Most of the ocean frontage is zoned R-3. Nothing would preclude a series of 20-story condominiums, providing density did not exceed 14 DU/acre and wastewater could be managed adequately.

Developers would be subject to the regulations of the Florida Department of Environmental Regulation and the Escambia County Health Department for the permitting of small community systems or individual on-site systems. Although the Perdido Key zoning resolution does not establish minimum lot sizes, the state septic tank laws require minimum lot sizes of one-fourth acre in subdivisions of 50 lots or less and one-third acre in subdivisions of 51-100 lots.

In several instances the zoning resolution declares that the ordinance will regulate population densities. This statement is true only in a rather general sense. What the zoning resolution does is regulate development densities. It is possible to calculate the number of dwelling units that could potentially be permitted given the existing zoning districts and adopted map. An average number of bedrooms and their occupancy rate could be calculated. These estimates, together with seasonal tourism fluctuations, could produce widely varying figures. Thus, the ordinance does no more than estimate a population range.

The zoning ordinance, together with state and local public health laws, can be a significant tool in providing environmental protection. Good coordination of state and local regulations and strict enforcement will be the critical factors in minimizing environmental impacts.

b. Wastewater Facilities Regulations

Control methods for wastewater facilities in Santa Rosa and Escambia Counties are used to protect environmentally sensitive areas and to effectively dispose of wastewaters. Although local ordinances, by virtue of the location of their administrators, can be the most effective means of dealing with the developmental and environmental issues raised in the 201 process, they are not often specific to wastewater facilities. Such facilities are regulated at the state level.

A number of state acts have an impact on water quality and environmental protection. They were legislated after the National Environmental Policy Act of 1969. Their effectiveness is related to the number of personnel and financial resources available for implementation. Pertinent state acts for wastewater disposal are listed below:

1970 Water Pollution Control and Sewage Treatment Plant Grant Act

1971 Environmental Protection Act

1972 Water Resources Act

1972 Land and Water Management Act

1974 Environmental Reorganization Act

1975 Local Government Comprehensive Planning Act

1976 Proposed Rule on Land Application of Domestic Wastewaters, Third Draft, December 14, 1976

1980 Chapter 10D-6, Standards for Individual Sewage Disposal Facilities, Rules of State of Florida Department of Health and Rehabilitative Services, Health Programs

1980 Chapter 17-6, Wastewater Facilities, Department of Environmental Regulation, Third Draft, November 1980.

State regulatory programs are effective in protecting and maintaining environmental quality in Florida, primarily because concern reaches all levels of the government. Coastal areas, wetlands, barrier islands and freshwater supplies are crucial issues in Florida and receive special consideration in state regulations. As regulations have been promulgated by EPA, Florida has sought to make their own regulations specific to the problems encountered in the state.

The State Department of Health and Rehabilitative Services implemented Chapter 10D-6 of the Florida Administrative Code, Standards for Individual Sewage Disposal Systems. It explicitly states the conditions under which on-site systems may or may not be installed. On-site systems may only be installed in subdivisions of 50 or less lots, each 0.10 hectare (one-fourth acre) in size or more, with a minimum property line dimension of 30.5 meters (100 feet) where there are private wells. They may also be installed in subdivisions of 100 or less lots, 0.135 hectare (one-third acre) in size or more, with a minimum property line of 22.9 meters (75 feet), if public water is supplied.

On-site systems may not be installed within one-quarter mile of a public collection system; within 22.9 meters (75 feet) of a private system or 30.5 meters (100 feet) of a public water supply well; within the ten-year floodplain; or areas with a water table less than 0.91 meters (36 inches) below the finished grade of the drainfield.

The regulations also determine how and where the disposal of septic tank sludges may occur. Acceptable methods include burial, incineration, sanitary landfilling, and landspreading. Sludge may not be discharged to drainage ditches or surface waters.

Chapter 17-6 of the Florida Administrative Code sets forth specific criteria designed to protect and maintain water quality through regulation of collection, treatment, and disposal policies. Major sections include design and performance considerations for domestic wastewater facilities, operation and maintenance of domestic wastewater facilities and compliance with permits. Water quality-based effluent limitations are determined based upon the discharge characteristics and state water quality criteria and standards. The regulations exclude domestic wastewater facilities or septic tank drainfields of 7.57 m^3/day (2000 gpd) flow per establishment, single connections to pretreatment facilities, and collection systems laterals 25.4 centimeters (ten inches) or less in diameter whose construction is under the independent regulatory purview of a county or municipality.

Surface water discharges and land application are carefully regulated. Discharges to Class I-A or II surface waters is prohibited. Land application system regulations are based upon the method in which the land is used. Application to fodder crops, forests and sod farms has different treatment criteria than application to golf courses, parks and public access areas or to pastures. No land application is permitted on crops intended for human consumption.

The West Florida Regional Planning Council has provided a good synopsis of existing regulations concerning package sewage treatment plants (small community systems) and potential recommendations to improve existing regulations. The synopsis, contained in Work Element No. C of the Continuing Planning Program was prepared by the Northwest Florida Water Management District and is included below:

> Chapter 17-6, Part 1, Florida Administrative Code establishes the authority, design criteria, effluent limitations and effluent disposal methods for domestic wastewater facilities including package sewage treatment plants. Wastewater facilities are divided into three classes based on the design average daily flow. These are summarized below:
>
> Type I Facility - A design average daily flow of 500,000 gallons per day or greater.
>
> Type II Facility - A design average daily flow of between 100,000 and 500,000 gallons per day.
>
> Type III Facility -A design average daily flow of between 2,000 and 100,000 gallons per day. All package plants in the project area are Type III.
>
> The effluent limitations established under paragraph 17-6.060 of the rule require that waste treatment at a minimum will consist of secondary treatment with appropriate disinfection and pH control. All package plants in the project area were found to meet this requirement. The actual effluent limitation, however, varies considerably depending on the effluent receiving body. Land application and groundwater disposal have the least stringent effluent limitations. Pre-disposal limitations on biological oxygen demand (BOD) and total suspended solids are not specified. Additional effluent limitations

are, however, set forth in the technical manual entitled "Land Application of Domestic Wastewater Effluent in Florida." This manual provides design, operation and maintenance criteria for land application systems discharging effluent to Class I-B groundwaters. As defined in Chapter 17-3, F.A.C., Class I-B groundwaters are those which have a total dissolved solids concentration of 10,000 mg/l or less. Thus, the sand-and-gravel aquifer is a Class I-B water.

Percolation ponds, into which effluent is discharged and allowed to percolate into the subsurface, are covered under Chapter 2 of the manual. Following is a summary of the pertinent requirements:

- The percolation ponds shall be divided into two or more cells to allow for alternative loading and resting.
- Pre-disposal treatment shall result in the effluent meeting secondary treatment and basic disinfection levels.
- The nitrate content of the effluent prior to spreading into the pond system shall not exceed 12 mg/l unless reasonable assurance is provided in the engineering report that nitrate, as measured in any hydraulically downgradient monitoring well, will not exceed 10 mg/l or background levels in the receiving groundwater, whichever is less stringent.
- A minimum separation of 500 feet is required between the discharge facility and shallow water supply wells.
- A 500-foot separation is recommended between the facility and Class I-A surface waters and Class II waters approved or conditionally approved for shellfishing harvesting. The minimum distance to other surface waters shall be established on a case-by-case basis by the Department of Environmental Regulation (in many instances, the recommended setback distance has not been followed.)
- The physical characteristics of the unconsolidated materials overlying bedrock shall be such that direct rapid movement of the percolation pond effluent to the underlying aquifers does not occur, unless treatment prior to discharge is adequate to insure compliance with groundwater quality provisions of Chapter 17-3 and 17-6 of the Florida Administrative code. A thin section of high permeability sand overlying fractured or cavernous limestone containing potential drinking water supply is an example of the condition to be avoided.

- Areas with average depths to the water table of ten feet or more are recommended for percolation ponds, however, areas with lesser depth may be acceptable.

- Percolation ponds should be located such that lateral subsurface movement of the effluent does not unpredictably affect the percolation rates of cells within the system.

- The design hydraulic loading (application) rate shall be related to the permeability and transmissivity of the geologic formations at the discharge facility and shall be evaluated, in depth, by the permittee with assistance from organizations or individuals qualified by training or experience in soil science, geology and hydrology.

- Hydraulic loading rates should be limited to three inches per day, or 1.9 gal/d per square foot of cell bottom on an annual average basis. Higher application rates not to exceed nine inches per day, or 5.6 gal/d per square foot of cell bottom may be considered if hydrogeologically feasible.

- Hydraulic loading periods of one to seven days with resting periods of five to 14 days to dry the cell bottoms are recommended.

- The application rate for individual percolation cells shall not exceed 25 percent of the documented vertical hydraulic conductivity.

The regulatory requirements for absorption fields and drain fields are essentially identical to the requirements for percolation ponds.

Detailed engineering reports are also required for all wastewater facilities, including discussions of the physical characteristics of the surface soil to a depth of 20 feet or at least 10 feet below the water table. Additional information is also required on the hydrogeology of the project site including physical characteristics of the aquifers (i.e., horizontal and vertical permeabilities, porosity, thickness, etc.), vertical heat gradient between aquifers, water level elevations, direction and rate of groundwater movement. For Type III facilities, however, the manual allows for abbreviated reports on the soil characteristics and hydrogeologic conditions based upon the "best available" information. As discussed in a subsequent section, little information is available at most sites, particularly on the hydrogeologic conditions. As a result, the engineering reports are of limited value for assessing the impacts of Type III facilities.

As in the case of ocean outfalls, Florida is writing its own regulations for groundwater injection, which are likely to be more stringent than the federal regulations. At the present time, Florida restricts deep-well injection to effluent which has received secondary treatment with tertiary filtration and chlorine disinfection. Wastewater may only be emplaced in aquifers with concentrations of TDS greater than 10,000 mg/l, preferably one which is separated from potable water supplies by two confining layers. Shallow well disposal sites are not permitted into water table aquifers which are sources of public water supplies except in the following circumstances: no other alternative is available; the discharge will not violate drinking water standards; the effluent has less than 1 JTU turbidity before disinfection; total N is less than 10 mg/l before discharge to the aquifer; and the effluent has less than 1 mg/l chlorine residual.

3. Community Services and Facilities

Community services and facilities in the study area are currently considered adequate for the existing population, based on national and local standards. However, community facilities must also be adequate to provide for future growth in order to prevent critical deficiencies and eliminate the need for hasty and costly expansion. Planning in the study area is currently underway to provide for future needs.

Police protection, educational facilities, libraries, hospitals and medical facilities, and administrative facilities are considered more than adequate for the existing population and allow for moderate growth in the Pensacola area. Fire protection in the study area, dependent primarily on volunteer fire companies, is considered inadequate, based on national standards. Solid waste disposal using sanitary landfill sites operated by Escambia and Santa Rosa Counties is currently adequate but in need of improvement in the near future. Planned expansion of existing landfill sites and the establishment of a new landfill site will provide for future growth. Transportation facilities, while generally considered adequate, will require continued maintenance and improvement as the need arises. Improvements to the Port of Pensacola and the rail freight facilities are planned in response to increasing port activity. Parks and recreation facilities are generally adequate except in the area of neighborhood parks, where improvements are currently scheduled. Private recreation facilities, dependent on a specific market, will likely increase in response to increasing tourism and overall leisure time.

Water supply and demand will probably be the critical issue in the future. Currently, water supply, dependent primarily on the sand-and-gravel aquifer, is keeping pace with water demand. However, as the demand for water increases and the aquifer recharge capacity decreases (due to increased development), saltwater intrusion may become a critical problem. Future water demand will probably be met with a combination of increased pumping capacity, new well sites, alternative (surface) water sources, and increased conservation and recycling.

a. Water Supply

The sand-and-gravel aquifer and the upper Floridan aquifer supply most of the potable water in the study area and will continue to be the major sources of potable water for the next 20 years. The sand-and-gravel aquifer is the principal source of the Pensacola Water System, the Escambia County Water System, the Peoples Water System, the Gulf Isles Utilities Company, and the Santa Rosa Utilities. The upper Floridan aquifer is used as the primary water source in the eastern portion of the study area by the Midway Water System, the Holley/Navarre Water System, and the Navarre Beach Water System. Most water systems in the study area are beginning to experience problems related to increasing demand and water resource limitations.

Private wells are a minor source of potable water in the study area. Based on population estimates provided by EPA and the Water System Study for the city of Pensacola, approximately 7,130 persons in the Escambia County portion of the study area are served by private wells (3.3 percent of the population). Most of the wells serve individual homes in the western and southwestern portions of the county. Few private wells are located on Santa Rosa Island or the Gulf Breeze Peninsula. Limited use of private wells has been authorized on Perdido Key; however, specific well locations and statistics are not readily available. Population projections indicate that by 1990 less than one percent of the study area's population will be served by private wells. In 1976, the Northwest Florida Water Management District began permitting private wells. Most existing wells were in place prior to the existing public water supplies and 1976. As a result, neither the Health Department or the Water Management District have an accurate assessment of the private wells on the barrier islands. However, as development encroaches areas served by private wells the property owners are required to connect to public water supplies.

The Santa Rosa Island Authority (SRIA), the Gulf Breeze Water Department and Perdido Key are currently the only entities in the study area with water supply limitations. Water supply to the SRIA is constrained by the size of the pipeline from the city of Pensacola. The city of Gulf Breeze is limited by the pumping capacity of the Midway Water System. The volume and pressure of water supplied to Perdido Key is inadequate to provide fire protection on much of the island due to increasing demand from medium- and high-rise condominiums. Improvements will be necessary in the near future to sustain growth in these areas.

Expansion of water supply and distribution facilities has been proceeding in several areas. New wells have recently been completed for the city of Pensacola, Santa Rosa Shores Utilities, and the Midway Water System. A new well for the Holley/Navarre Water System is under construction and the Gulf Isles Utilities is planning the development of a new well field. These new facilities are needed to meet the projected demand on the Gulf Breeze Peninsula.

Various engineering reports prepared for the water supply companies provide water demand projections which indicate a 63 percent demand increase in water demand by the year 2000 to a total demand of nearly 52 million gallons per day (mgd). The projected demand can be met by either increased pumping of existing wells or the development of new wells and distribution facilities. Since increased pumping along the coastal areas is inhibited by saltwater intrusion, increased turbidity and iron contamination (at some locations), development of new well fields farther inland and expanded distribution facilities will likely be necessary to meet increasing water demand in the coastal areas.

Additional studies have recently been conducted to provide more detailed information about the study area's water resources and facilities. The U.S. Geological Survey has conducted an analysis of the hydrologic budget of the sand-and-gravel aquifer in Escambia County. The Northwest Florida Water Management District (NWFWMD) has analyzed the public water supply facilities and resources in the coastal areas of Escambia, Santa Rosa, Okaloosa and Walton Counties.

Table III-2 indicates the projected water demand for each of the service areas in the study area.

b. Solid Waste Disposal

Solid waste collection in the Escarosa study area is provided by a combination of public departments and private contractors. Within the city of Pensacola, trash and garbage collection is provided by the City's Department of Public Services or a private contractor. Garbage collection in the city of Gulf Breeze is provided by one private contractor, who is given the exclusive franchise rights by the City Council. The Santa Rosa Island Authority operates and maintains its own collection service for its jurisdiction. Collection in other areas of the county is provided by franchised collectors.

Solid waste disposal in the Escarosa study area is provided exclusively by sanitary landfills operated by Escambia and Santa Rosa Counties. Solid waste from the city of Gulf Breeze and the Navarre Beach area is disposed at a Santa Rosa County-operated landfill site, Holley No. 2, located south of Eglin Air Force Base. This landfill site is operated in compliance with regulations established by the Florida Department of Environmental Regulations. The only problem with this site is the long travel distance from the city of Gulf Breeze (approximately 26 miles). Future plans call for the expansion of the landfill at Holley No. 2 onto an additional 40-acre leased tract.

Other jurisdictions in the study area use landfill sites owned and operated by Escambia County. Currently, the county's sites at Beulah and Klondike have either reached or are rapidly approaching capacity. The landfill at Beulah has been closed to all but wastewater sludge. The Klondike site was recently expanded by the acquisition of additional acreage, allowing the facility to remain open for an additional year.

In response to the need for additional landfill capcity, Escambia County has purchased a 424-acre tract north of Interstate 10 and has acquired a construction permit from the Department of Environmental Regulation. This site is scheduled to open with the closing of the Klondike site and should serve the needs of Escambia County for at least the next twenty-five years.

c. Recreation

Public, private and semi-private recreation facilities in the Escarosa study area complement one another and offer a variety of facilities and opportunities for residents and tourists. Public facilities owned and

Table III-2. Projected Water Demand by Service Area in the Escarosa Study Area in Millions of Gallons per Day (mgd)

	1981 (existing)	1985	1990	1995	2000
Pensacola	25.40	26.92	28.61	31.71	34.41
Peoples	2.50	3.01	3.71	3.33	3.49
Escambia Co. District I		1.09	1.19	1.27	1.36
Escambia Co. District IV	1.30	1.34	1.44	1.57	1.71
Gulf Breeze	.74	.85	.85	.84	.83
Gulf Isles	.14	.30	.30	.30	.30
Santa Rosa Shores	.23	.33	.39	.39	.39
Midway	.23	.45	.61	.77	.93
Holley/Navarre	.31	.47	.63	.79	.95
SRIA		.93	1.34	1.74	2.14
SRCBA	.94	2.02	3.09	4.18	5.26
	31.79	37.71	41.62	46.89	51.77

Source: City of Pensacola, Water System Study, Boyle Engineering Corporation, October 1980; Polyengineering Inc., 1980; Baskerville-Donovan, Inc., 1980, Claude Terry & Associates, 1981.

operated by the various jurisdictions in the area are most adequate in the categories of mini-parks, community parks and urban/regional parks. The variety of facilities offered at these parks include ballfields, tennis facilities, playgrounds and picnic areas. Additional public facilities offer boat ramps and camping. The regional parks in the area provide large areas of natural, undeveloped land suitable for camping, hiking and other outdoor activities. These regional parks include Gulf Islands National Seashore, Blackwater River State Park and Eglin Wildlife Reserve.

Private and semi-private facilities in the study area generally offer recreation opportunities that are unavailable at public facilities. Golf courses and racquetball clubs are the primary private recreation facilities in the Pensacola area. Marinas are also included in the category of private recreation facilities since marinas in the area cater primarily to the recreational boating community. Boating and water-related sports are major recreation activities in the Pensacola area. The availability and variety of recreation facilities in the Pensacola area reflects the growing importance of recreation. Locally, the importance of tourism is also responsible for the emphasis on recreation facilities.

4. Economic Profile

A regional economic profile involves the ananlysis of local economic indicators, area industries and natural resources. An analysis of local financial considerations can also be used to provide an indication of the financial stability of the local governments. An economic profile of the Pensacola region indicates a moderately diverse, stable economy with projections for slow, positive growth.

a. Economic Indicators

Civilian labor market, personal income and retail sales are often used as indicators of an area's economic stability. In the Pensacola SMSA, these indicators show a stable economy of regional prominence. Projections based on current trends indicate a slow-growing economy relative to other urban areas in the Florida panhandle as well as the state of Florida.

The civilian labor market in the Pensacola SMSA is estimated at approximately 95,900 employees. Major industries include government (26,000 employees), trade (23,000 employees) and services (18,300 employees). While most industries have steadily increased employment since 1974, construction (6,300 employees) and manufacturing (13,200 employees) have posted steady decreases in employment. Projections indicate the service industry will become the major source of employment in the Pensacola SMSA.

Statistics for the Pensacola SMSA indicate declining per capita income due to increased dependence on transfer payments (social security, unemployment payments) and rising employment in the services and retail trade industries. Effective Buying Income (a measure of buying power) is another measure of household income, and in 1979 median household EBI in the Pensacola SMSA was below the median household EBI for both Tallahassee and Florida. Projections indicate increasing EBI in the Pensacola SMSA, keeping pace with the rest of the state but not improving its relative position.

Retail trade statistics indicate that the Pensacola SMSA is the retail center of the Florida panhandle in terms of dollar volume. While sales have declined in several categories in the past two years (general merchandise, furniture and appliances), other categories have shown increased sales. Projections of retail sales indicate modest growth for the Pensacola area, lagging slightly behind other urban areas and the state of Florida.

b. Area Industries

The Pensacola area economy is supported primarily by three industries: tourism, U.S. military, and manufacturing. While no one component is considered critical to the area economy, military expenditures and tourism comprise the major economic base.

Tourism in the Pensacola area is considered a growing industry. Annual increases in terms of number of tourists and total expenditures have been realized since 1976. In 1979, an estimated 1,557,000 tourists contributed more than $233 million to the area economy. The positive trends of the past several years are expected to continue as local promotional activities have been increased.

U.S. military involvement in the Pensacola area has a long history and has become a major part of the local economy. The major military facilities in Pensacola are owned by the U.S. Navy and include the Naval Air Station, the Naval Air Rework Facility and several other naval airfields. Eglin Air Force Base is another major military facility located within the study area. While the future of several military facilities is uncertain, the recent resurgence of concern about national defense indicates a positive trend for military installations in the Pensacola area.

Manufacturing in the Pensacola area primarily involves the chemical and paper industries. The two largest manufacturers in the area are Monsanto (chemicals) and St. Regis Paper Company. Although still considered a major economic factor, manufacturing is becoming less important in the local economy due to steady cut-backs in employment. Improved tax incentives and increased industrial development activities are expected to reverse the recent trends in manufacturing employment.

c. Natural Resources

Natural resources are natural features possessing actual or potential economic value. The value of these resources may result directly from primary exploitation, or indirectly from secondary economic benefits. Quantitative figures showing the economic worth of natural resources are often difficult to obtain and are best considered as estimates.

Fisheries are the most important natural resource within the study area. Although many of the fish processed in local ports are landed in waters outside the study area, a significant portion of this catch is from local waters. For instance, local water quality problems in the late 1960's and early 1970's have been associated with significantly decreased fisheries landings in those years (USEPA 1975).

Other regionally important natural resources include forestry, agriculture and mining, but the primary exploitations of these resources occur in the northern two-thirds of Escambia and Santa Rosa Counties. These resources provide valuable secondary economic benefits to communities within the study area.

d. Local Financial Considerations

The City of Pensacola and Escambia County are the primary jurisdictions in the Escarosa study area. An analysis of their revenues and expenditures indicates the financial status of the area and the capacity for increasing revenue and services. The following analysis is based on figures from FY 1976, according to the 1977 U.S. Census of Government.

The two major categories of revenue are local sources (taxes, fees and charges) and intergovernmental grants. For the City of Pensacola, intergovernmental grants account for approximately 45 percent of all revenue while local sources contribute 55 percent. Of all local sources, taxes provide 40 percent and current charges provide 44 percent. The most underutilized source of revenue in Pensacola is the property tax, which contributes only 7 percent of all revenue. In recent years the city has reduced the millage rate as rising assessments have kept property tax revenue stable.

Expenditures of Pensacola are primarily for provision of municipal services (68 percent) as opposed to capital outlays (32 percent). The major expenditure in FY 1976 (according to the U.S. Census of Government) was for sewage treatment (approximately 32 percent of total expenditures). A large portion of this expenditure involved capital improvements. Interest on general debt accounted for approximately 5.5 percent of total expenditures in 1976.

Revenues and expenditures for Escambia County differ from those of the City of Pensacola. Intergovernmental grants account for only 30 percent of all County revenue while tax revenue (property and sales) alone contributes approximately 30 percent. Charges and miscellaneous sources provide the other 40 percent of total revenues. Capital outlays account for less than nine percent of all expenditures in Escambia County. The largest single expenditure in Escambia County is for hospitals, approximately 21 percent of all expenditures for FY 1976. Other major expenditures include police protection (11.6 percent of total) and highways (8.9 percent of total). Interest on general debt accounts for approximately 7.1 percent of total expenditures.

Water and sewer rates are by far the major user charges in the Pensacola area. The various jurisdictions and water companies necessitate a relative comparison based on average estimated consumption. All jurisdictions have a graduated rate structure for both water and sewer based on water consumption. Based on a family of four with an average consumption of 100 gal/person/day, the estimated water bills range from $7.39/month for the City of Pensacola to $15.96/month for the City of Gulf Breeze. Sewer rates, based on water consumption, range from $12.30/month for the City of Gulf Breeze to $16.28/month for the City of Pensacola. Water users in Escambia County outside the jurisdiction of Pensacola may receive their water from the city for a slightly higher charge. Recently the City of Pensacola and Escambia County have combined to create a special Water and Wastewater Authority based on the water service area. The water and sewer rates will be adjusted in the near future to eliminate the current differential between city residents and county residents. The new rate structure and average estimated charges are not known at this time.

Solid waste collection is another municipal service funded by user fee. Residents of Gulf Breeze, Pensacola and Santa Rosa Island pay an average of $7.00/month for garbage collection.

Property taxes vary throughout the study area and also constitute a major portion of homeowner costs. Residents of Escambia County pay county property taxes of 16.35 mills on 100 percent of the assessed property value. Residents of Santa Rosa County pay county property taxes of 9.2 mills. Florida State Statutes establish a maximum municipal tax rate of 10.0 mills. Both the City of Pensacola (3.81 mills) and the City of Gulf Breeze (2.0 mills) are well below the legislated limit. City property taxes represents the most readily available source of increased revenue.

5. Historic and Archeological Resources

A number of known historic sites are found in the two-county area (Tesar, pers. comm.) and are listed in the National Register of Historic Places (U.S. Dept. of Interior, National Park Service 1973). A list of the most important sites is included in the 201 Facilities Plan (1978). Most of these historic sites are associated with Pensacola and the barrier islands. Some of the most important historic sites in the study area include Fort Pickens (site of the major Civil War conflict), Fort George (site of the siege of Pensacola in 1781), Christ Church (oldest building of worship in northwest Florida), Light House (built in 1859 and marks the involvement of U.S. Navy in the area), Seville Square Historic District (site of the mid-eighteenth century settlement of Pensacola), and Battery San Antonio (built 1803-1814 as a defense for Spanish forces). In addition, numerous buildings in the area are listed as historic landmarks (201 Facilities Plan 1978).

Particular reference to actual archaeological sites for the Escambia-Santa Rosa areas is difficult because so much of this area has not been surveyed at the present time (Tesar, pers. comm.). However, certain assumptions can be made based on the ecotonal breaks (e.g., vegetation and soil type) for this area (Tesar, pers. comm.; Lauderdale, pers. comm.).

Based on the 26 ecotonal types used by Louis Tesar in his study for the Eglin AFB, the following statements are made for each of these zones. Most of the 26 ecotonal types present a low frequency of occurrence for archaeological sites and include: moving coastal dunes, rosemary sand pine scrub, sand pine scrub, turkey oak-sand pine-longleaf pine, turkey oak-longleaf pine, mesic hammock, hydric hammock, ravine forest, bayhead, stream banks, fluvial swamps, bogs, ponds, fresh water and saltwater marsh, reforested areas, open ranges, roadsides, and utility pole lanes. The areas with some likelihood of sites include sand pine-turkey oak with persimmon and magnolia, xeric hammock, and stationary coastal dunes. The most important sites occur in the xeric hammock ecotone.

6. **Wastewater Facilities**

Wastewater systems are generally divided into regional systems (Main Street Plant), subregional systems (subdivision package plants), and on-site systems (septic tanks). Each are represented in the study area but most wastewater is handled by regional facilities. An important aspect of wastewater management alternatives development and evaluation is an analysis of existing and projected wastewater systems. An inventory of existing systems provides data on remaining capacities of existing systems. With regard to on-site systems, the analysis indicates those areas where on-site systems have proved successful and those areas (soils) where they have failed.

The Main Street Wastwater Treatment Plant serving Pensacola is the largest treatment plant in the study area. Currently completing a program of expansion and modification, this plant is operating at an expanded 75,700 m^3/day (20.0 mgd) capacity with multiple hearth incineration of sludge. The plant is preparing to go on-line with advanced treatment. Table III-3 contains a further description of this facility. Operating characteristics for the Main Street Plant since expansion are shown in Table III-4.

Descriptions of other facilities in the study area with design capacities greater than 378 m^3/day (100,000 gpd) are also given in Table III-3. These smaller plants generally utilize some form of activated sludge treatment and dispose of their sludge to a landfill after digestion. Except for the Scenic Hills and Santa Rosa Shores Plants, which utilize spray irrigation, all of the plants discharge their effluent to surface waters. Operating characteristics are shown in Table III-4. Some systems experience large seasonal variations in flow.

There are 22 treatment plants with capacities of 378 m^3/day (100,000 gpd) or less in the Escarosa study area. The majority of these package plants make use of extended aeration treatment with disposal to percolation ponds. Table III-5 contains descriptions of these systems. Seasonal variations in flow are also experienced by many of these facilities.

Only one industrial wastewater treatment facility with capacity greater than 3,785 m^3/day (1.0 mgd) is located in the study area. Located at the Pensacola Naval Air Station (NAS), this plant treats both domestic and industrial wastewaters. Five industrial facilities located outside the study area have the potential to affect water quality within the study area because of their surface water discharges. There are three chemical companies: Air Products, American Cyanamid, and Monsanto; a paper company, St. Regis; and a power company, Crist Electric.

Individual on-site disposal systems are regulated by Chapter 10D-6, State of Florida "Standards for Individual Sewage Disposal Facilities." The use of these systems are regulated by the Florida Department of Health and Rehabilitation Services and the county health departments. Prior to the

Table III-3. Existing Wastewater Treatment Facilities Capacities Greater Than 378 m^3/day (0.1 MGD)

Treatment Plant	Owner or Operating Authority	Design Capacity, m^3/day (mgd)	Treatment Process Wastewater/Sludge	Effluent Disposal	Sludge Disposal
City of Pensacola					
Main Street	City of Pensacola	75,708 (20.0)	Advanced[1]/incineration	Pensacola Bay	Sanitary Landfill
Scenic Hills	City of Pensacola	3,785 (1.00)	Activated sludge/incineration at Main Street	Spray irrigation	Sanitary Landfill
Mainland Escambia County					
Avondale	Escambia County	3,785 (1.00)	Contact Stabilization/Aerobic digestion	Bayou Marcus	Beulah Landfill[2]
Pen Haven	Escambia County	1,136 (0.30)	Trickling Filter/Aerobic digestion	Bayou Chico	Beulah Landfill[2]
Warrington	Escambia County	7,571 (2.00)	Contact Stabilization/Aerobic digestion	Jones Swamp Creek-Bayou Chico	Beulah Landfill[2]
Moreno Courts	Pensacola Housing Authority	795 (0.21)	Extended aeration, package plant/Anaerobic digestion	Jones Swamp Creek-Bayou Chico	Sanitary Landfill
Pensacola NAS					
Industrial	U.S. Navy	3,785-4,732 (1.00-1.25)	Aerated equalization, biological treatment of phenols/sludge drying beds	Pensacola Bay	Hazardous Waste secured landfill in Alabama
Domestic	U.S. Navy	11,356 (3.00)	Extended aeration/Aerobic digestion	Pensacola Bay	Landfill or landspread
Saufley Field	U.S. Navy	795 (0.21)	Trickling filter/Aerobic digestion	Drainage ditch to Perdido Bay	Sanitary Landfill
Santa Rosa Island					
Pensacola Beach	Santa Rosa Island Authority	4,542 (1.20)	Activated sludge/Sludge thickening	Santa Rosa Sound	Beulah Landfill[2]
Navarre Beach	Santa Rosa County Beach Administration	1,703 (0.45)	Contact stabilization/Aerobic digestion	Santa Rosa Sound	Holly Landfill
Santa Rosa County					
Gulf Breeze	City of Gulf Breeze	1,893 (0.50)	Extended aeration <0.30 mgd, Contact stabilization >0.30 mgd/Aerobic digestion	Santa Rosa Sound	Holly Landfill
Santa Rosa Shores	Santa Rosa Shores Utility Company	492 (0.13)	Extended aeration/Aerobic digestion	Spray irrigation to golf course	Holly Landfill

1. Treatment includes phosphorus control, nitrification, denitrification, and ozonation.
2. Sludge to be incinerated at Main Street in the future.

Sources: "201 Facilities Plan for South Escambia and Santa Rosa Counties"; 208 Supplement, "Residual Waste Management Work Element 530"; Owners and operating authorities.

Table III-4. Average Effluent Characteristics for Domestic Wastewater Treatment Facilities Capacities Greater than 378 m^3/day (0.1 mgd)

			Average Concentrations, mg/l (lb/mgal)						
Treatment Plant	Population Served	Average Flow m^3/day (mgd)	BOD$_5$ inf/eff	TSS inf/eff	Nitrogen	Total P	pH	Chlorine Residual mg/l (lb/mgal)	Range of Fecal Coliform Values per 100 ml (Values per pint)
Main Street[1]	120,000	38,611 (10.2)	279/10 (2328/83)	782/10 (6526/83)	15(125) (TKN)	4 (33)	7.4	1.2 (10.0)	2-25 (9.5-118)
Scenic Hills	2,800	1,060 (0.28)	154/6 (1285/50)	146/4 (1218/33)	-	-	6.8	0.8 (6.7)	0-5 (0-24)
Avondale	11,950	3,770 (0.996)	210/8 (1752/67)	162/12 (1352/100)	-	-	7.2	0.6 (5.0)	2-228 (9.5-1079)
Pen Haven	6,660	1.476 (0.390)[3]	188/10 (1569/83)	168/12 (1402/100)	-	-	6.8	0.5 (4.2)	2-647 (9.5-3062)
Warrington	18,000	4,921 (1.3)	188/2 (1569/17)	170/2 (1419/17)	-	-	6.8	0.5 (4.2)	0-13 (0-62)
Moreno Courts	2,100	447 (0.118)	144/10 (951/83)	49/9 (409/75)	-	-	6.8	0.9 (7.5)	0
Pensacola NAS[2]	-	10,220 (2.7)	-/9.2 (-/80)	-/11.6 (-/97)	2.3(19) (TKN)	1.0 (8.3)	6.9-7.2 (Average range)	0.8 (6.7)	2-16 (9.5-76)
Saufley Field	-	216 (0.057)	-/7.5 (-/62)	-/5.5 (-/46)	-	-	6.3-6.6 (Average range)	1.54 (12.8)	0-11 (0-52)
Pensacola Beach	8,240	2,760 (0.729)	93/6 (776/50)	96/6 (801/50)	-	-	6.6	1.2 10)	3-28 (14-132)
Navarre Beach	1,250	481 (0.127)	87/7 (726/58)	81/5 (676/42)	-	-	7.2	0.6 (5.0)	2-93 (9.5-440)
Gulf Breeze	2,100	821 (0.217)	264/18 (2211/150)	306/16 (2554/134)	20(167) (Total N)	4.6(38)	7.1	1.1	2-1430 (9.2) (9.5-6768)
Santa Rosa Shores	1,138	534 (0.141)	260/14 (2170/117)	333/17 (2779/142)	-	-	5.8	0.8 (6.7)	2 (9.5)

Sources: Florida DER Northwest District Office Files
Department of the Navy, Southern Division, Naval Facilities Engineering Command.

Period of record for this table - October 1979 through September 1980

1. Main Street is presently completing expansion and modification. Values cited represent operation since expanded plant went on-line, 2-12-80, however, not all of the advanced treatment processes have been completed.
2. Pensacola NAS treats both domestic and industrial wastewaters; cited values are for combined effluent. Period
3. Severe infiltration problems.

Table III-5. Existing Wastewater Treatment Facilities Capacities of 378 m^3/day (0.1 mgd) Or Less

Treatment Facility	Design Capacity m^3/day, (mgd)	Treatment Process	Receiving System	Present Flow, m^3/day, (mgd)	Percent BOD Removal
Escambia County					
Azalea Trace	227 (.060)	Extended aeration	Percolation pond	under	construction
Bayou Grande Villas	155 (.041)	Extended aeration	Bayou Grande	26.5 (.007)	96
Beulah Elementary	56.8 (.015)	Extended aeration	Percolation pond	under	construction
Florida DOT I-10	56.8 (.015)	Extended aeration	Drainage ditch	3.78 (.001)	96
Fountain Blue MHP	47.3 (.0125)	Extended aeration	Bayou Chico	37.8 (.010)	92
Grande Lagoon	189 (.050)	Extended aeration	Percolation pond	159 (.042)	97
Grantwood Apartments	62.4 (.0165)	Extended aeration	Percolation pond	18.9 (.005)	97
Lakeview Mobile Estates	227 (.060)	Extended aeration	Eight Mile Creek	98.4 (.026)	96
Mariner Condominiums	227 (.060)	Extended aeration	Percolation pond	155 (.041)	97
Pensacola Greyhound Park	90.8 (.024)	Extended aeration	Drainfield	41.6 (.011)	96
Perdido Bay C.C.	265 (.070)	Contact stabilization	Percolation pond	174 (.046)	92
Perdido Key Condominium	94.6 (.025)	Extended aeration	Drainfield	under	construction
Pine Forest Work Plant Center	18.9 (.005)	Extended aeration	Drainfield	11.4 (.003)	78
Sandy Acres MHP	15.1 (.004)	Extended aeration	Subsurface drainage	7.57 (.002)	91
Sundown Condominium	90.8 (.024)	Extended aeration	Percolation pond	11.4 (.003)	95
Timberlake MHP	114 (.030)	Extended aeration	Bayou Marcus Creek	94.6 (.025)	96

Table III-5. Continued

Treatment Facility	Design Capacity m^3/day, (mgd)	Treatment Process	Receiving System	Present Flow, m^3/day, (mgd)	Percent BOD Removal
Escambia County					
Vista Del Mar	189 (.050)	Extended aeration	Percolation pond	37.8 (.010)	97
Weekly Bayou	114 (.030)	Extended aeration	Drainfield	159 (.042)	94
Windward Condominium	227 (.060)	Contact stabilization	Percolation pond	41.6 (.011)	99
Santa Rosa County					
Colonial Pines Mobile Estates	75.7 (.020)	Extended aeration	Drainfield	34.1 (.009)	95
Holly-Navarre Elementary School	34.1 (.009)	Extended aeration	Subsurface drainfield	7.57 (.002)	98
Villa Veynce Subdivision	378 (.100)	Extended aeration	Percolation pond	170 (.045)	94

Sources: "201 Facilities Plan for South Escambia and Santa Rosa Counties" and Florida DER.

installation of any system, a permit from the Health Department must be obtained. Presently, the health departments are in charge of issuing permits for systems up to 18.9 cubic meters per day (5,000 gals. per day). Larger systems are under the jurisdiction of the Florida Department of Environmental Regulation.

All subsurface disposal systems must be permitted prior to construction. Permit applications must contain information regarding individual system suitability, including lot size and the results of investigations by qualified professionals made during the wettest time of the year. These investigations include consideration of percolation characteristics, soil profiles, water table elevations, flood history, and the performance record for individual systems in adjacent areas. The state regulation also pronounces that if a wastewater collector pipe is available within 30.5 meters (100 feet) of a property line, on-site individual treatment systems are not to be used.

Septic tank and absorption field construction standards are specifically given in the State Code. Required capacities of septic tanks for various types of buildings are also given. Final inspection of in-place facilities is required before covering with earth and placing into service. Only after such an inspection is an operating permit issued by the county health departments.

A widespread use of on-site disposal systems continues in the study area where sanitary wastewater service is not available. Much of the new multi-family development on Perdido Key continues to use subsurface sewage disposal techniques as do other undeveloped sectors in the study area. Many of the systems in use consist principally of conventional septic tanks and disposal fields with trenchs or seepage beds. Alternate disposal techniques, such as elevated sand mounds, are used less frequently to overcome minor limitations with high water tables. No alternatives presently exist in the state regulations to overcome limitations associated with slowly permeable soils with measured percolation rates exceeding 5.90 minutes per centimeter (15 minutes per inch).

The Escambia County Health Department recognizes several problem areas within the study area. These are, generally, the low-lying, poorly drained, lowland sectors around Bayou Grande such as Beach Haven and Star Lake. Several other problems have also been noted in the older sectors of the Edgewater and Lakewood developments that are adjacent to Bayou Chico. Portions of these areas are situated on poorly to very poorly drained soils with seasonally high water tables. In general, periodic flooding problems occur in the low-lying coastal areas whenever prolonged rainfall events cause the already shallow water tables to rise and remain at or near the surface.

D. Description of Environmental Concerns and Mitigation Associated with Alternatives

An environmental evaluation of alternatives involves data analysis, assessment of impacts on the natural and man-made elements, and comparison of impacts associated with alternatives. Important natural elements include air quality, noise, odors, soils, geology, topography, water quality, aquatic ecosystems, and terrestrial ecosystems. Important man-made factors include land use, population, community services, economic resources, and historical/archaeological resources.

The decision tree methodology displayed in Figure III-1 was developed to distinguish environmental impacts of minimal concern from those impacts that were considered essential in the comparison of alternatives. Impacts of minimal concern are primarily minor or insignificant in magnitude, temporary in duration, and localized in effect. These impacts are most likely to result from the construction or operation of wastewater treatment facilities and can usually be prevented or mitigated by standard design and management practices. Examples of such impacts include noise and soil erosion from construction activities and odor problems caused by temporary wastewater treatment plant malfunctions.

Other impacts were considered minimal because they were insignificant or negligible in relation to the resources of the affected parameters in the study area as a whole. For instance, wastewater treatment plants typically emit small amounts of air pollutants such as nitrous oxides. However, these pollutants are easily assimulated by the surrounding atmosphere and are usually inconsequential in relation to the amounts of air pollutants derived from other sources, such as automobiles.

Impacts that were common to all of the alternatives were also considered minimal from the standpoint of alternatives evaluation. Although these impacts in some cases may be large in magnitude or duration, such common impacts are of little use in comparing the relative acceptability of different alternatives.

The following sections describe environmental concerns common to most alternatives and potential mitigation procedures for those concerns.

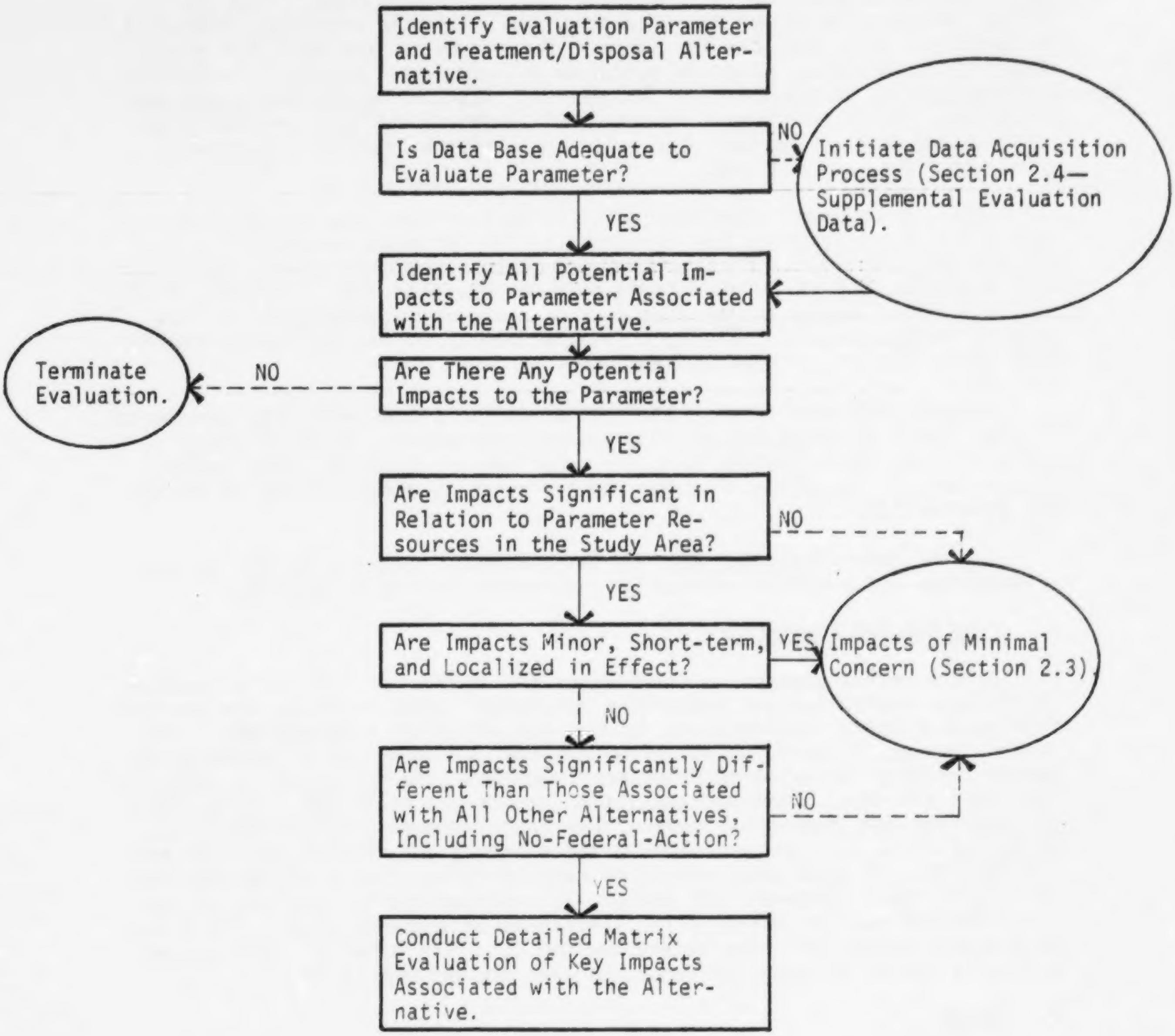
1. Land Use and Population

Before recent changes in Clean Water Act regulations deleted allowances for future development and associated wastewater needs, land use and population were a prime consideration in the evaluation of alternatives. The recent changes, however, do not allow for the consideration of future development but only for existing problems. Therefore, the influences on controlling land use development and population growth are minimized. Assessments of land use and population remain important concerning environmentally sensitive areas such as Southwest Escambia County and Perdido Key that are not sewered. If such areas exhibited major problems they could be resolved by central sewer systems. Of course, in environmentally sensitive areas other factors such as building in floodplains or wetlands usually limit the development potential. The recent changes in Clean Water Act regulations basically act to mitigate influences on land use and population.

2. Noise

Impacts on noise levels may be associated with all of the wastewater management alternatives. The operation of equipment and vehicles during the construction of wastewater treatment plants and conveyance lines will result in elevated noise levels which should be temporary in duration and limited to

Figure III-1. Generic Decision Tree Utilized in the Alternatives Evaluation Procedure.


Identify Evaluation Parameter and Treatment/Disposal Alternative.
Is Data Base Adequate to Evaluate Parameter?
NO
Initiate Data Acquisition Process (Section 2.4—Supplemental Evaluation Data).
YES
Identify All Potential Impacts to Parameter Associated with the Alternative.
Terminate Evaluation.
NO
Are There Any Potential Impacts to the Parameter?
YES
Are Impacts Significant in Relation to Parameter Resources in the Study Area?
NO
YES
Are Impacts Minor, Short-term, and Localized in Effect?
YES
Impacts of Minimal Concern (Section 2.3).
NO
Are Impacts Significantly Different Than Those Associated with All Other Alternatives, Including No-Federal-Action?
NO
YES
Conduct Detailed Matrix Evaluation of Key Impacts Associated with the Alternative.

daylight hours. Noise impacts of lower intensity but longer duration will result from the operation of pumping stations, sprinkler heads and other wastewater treatment facilities. In all instances, adverse impacts from elevated noise levels should be minor in effect because they are localized.

A variety of standard methods are available for the mitigation or control of noise problems. Leffel (1976) recommends that noise can be most efficiently controlled at the source with the proper design and siting of wastewater treatment facilities. Recommended techniques for mitigating potential noise problems include architectural designs which absorb sound and isolate loud equipment; use of mufflers and other noise reduction devices; siting of plants in isolated locations; and use of vegetative screens and buffer zones to absorb sounds.

3. Odors

Although odor problems can sometimes result in major impacts, for the purpose of comparing alternatives such impacts were considered minimal. This determination was justified because odor problems are generally short-term in duration, localized in effect, and readily prevented or mitigated by proven measures. Additionally, properly designed and operated treatment facilities should not experience long-term odor problems. Any temporary odor problems which may occur are generally non-predictable and may be associated with all of the various wastewater management alternatives. Because odor problems have been associated with the Main Street plant, however, the following discussion is included.

Objectionable odors in the vicinity of wastewater treatment facilities may result from three common sources:

1. Incomplete oxidation of organic material contained in wastewater, causing the formation of malodorous compounds of sulfur and nitrogen
2. Accumulation of slime, sludge or other organic waste deposits resulting in the production of H_2S and other odorants
3. Release of H_2S and other odorants from wastewaters at points of turbulence, such as freefalls (Leffel 1976).

Other potential sources include oil, grease, fats and soaps from industry, homes and urban runoff; gaseous emissions from treatment processes, manholes, wells, pumping stations and leaks; chlorinated water containing phenols; and dredged or excavated matter (Leffel 1976).

For a comprehensive review of odor control techniques, refer to the EPA publication "Direct Environmental Factors at Municipal Wastewater Treatment Works," (#MCD-20) by Leffel (1976). Some of the important design elements and operational practices recommended by this publication include:

1. Locate the facility on a well ventilated site to prevent odor accumulation, not in a hollow or where it will be closely surrounded by trees.

2. Provide for sufficient mixing to ensure scouring velocities over the entire floor of aeration basins and to prevent sludge accumulation in corners where velocities are low.

3. Enclose locations of turbulent flow where odorants or aerosols might escape from anaerobic wastewater or sludge to prevent escape of odorants and to collect them for oxidation before discharge to the atmosphere. Such locations may include headworks, primary clarifiers, trickling filters, sludge thickeners, sludge dewatering tanks, and sludge holding tanks.

4. Provide high pressure connections for hoses for use in the daily flushing of walls and corners to prevent any accumulation of slime or sludge.

5. Provide adequate slopes in all conduits, whether open or closed, to ensure scouring velocities once a day.

6. Provide for mechanical cleaning of all closed conduits, if slopes are not sufficient to ensure daily scouring velocities.

7. Provide for U-tube aeration of anaerobic wastewater in manholes upstream of pumping stations or treatment facilities or provide a means of adding hydrogen peroxide, chlorine, or hypochlorite, if the sulfide problem is too much for simple aeration, to prevent escape of odors at the pumping station or treatment facility headworks.

8. Provide aeration in distribution channels to maintain aerobic conditions as well as to ensure homogeneity of the organic material in the wastewater.

9. Provide for returning a portion of the waste activated sludge to the headworks to assist in reducing odors.

10. Provide for pneumatic or other enclosed transfer of screenings or other odorous compounds to the disposal point.

11. Provide a vacuum cleaner truck for cleaning grease traps, screening boxes, scum boxes, and catch basins and for carrying their odorous contents in an enclosed tank to the disposal point.

12. Provide an adequate section in the facility operation and maintenance manual on odor control. This should include procedures for daily flushing to remove slime and sludge accumulations; for checking for sufficient conditioning of sludge before its discharge to open drying beds or use as fertilizer on lawns; for cleaning all sludge discharge pipes and areas immediately after use; for preventing overuse of treated wastewater for irrigation; and for using sulfuric acid or caustic soda for removing slime or lime encrustations.

13. Provide requirements in the sewer ordinance for removal or for reduction to a treatable level of all industrial waste compounds

which might cause odor problems at a properly operated wastewater facility.

4. Air Quality

Impacts on air quality (excluding odors) from wastewater treatment facilities are generally considered negligible if required air pollution control equipment and management techniques are maintained. Incineration of sewage sludge is the greatest potential source of air pollutants, with unfiltered or improperly treated emissions containing particulates, metals, and various gases (WPCF 1977). If properly operated, scrubbers are capable of keeping such incineration emissions well within air quality standards (WPCF 1977). Although gaseous emissions may contain hydrogen chloride, sulfur dioxide, nitrogen oxides, and carbon monoxide, sludge incineration does not usually emit such pollutants in significant concentrations, and some of these gases are further reduced by scrubbers (WPCF 1977). Accordingly, any adverse impacts to air quality from sludge incineration are anticipated to be negligible and may be mitigated by routine maintenance and monitoring procedures.

Aerosols containing pathogens are another potential adverse impact to air quality from wastewater treatment facilities. Such aerosols would be generated in significant amounts only by sprinklers used in spray irrigation systems. However, studies of such systems have shown no conclusive evidence of increased incidence of diseases near such facilities (Leffler 1976) and chlorination of secondary effluents would effectively mitigate any possible hazards.

Construction activities will also result in minor, temporary degradations of air quality localized in the vicinity of construction sites. Such pollutants primarily consist of dust and exhaust emissions generated by construction equipment. The following summaries of air quality problems and control methods as recommended by Leffel (1976) and Carroll (undated) are organized according to various construction activities:

1. Clearing, grubbing, and stripping. Control dust by water sprinkling and chemical treatment such as use of calcium chloride. Seeding may be effective. Light petroleum or bituminous surface treatment may be used. Vegetative buffer zones maintained around construction sites can trap a substantial amount of fugitive dust.

2. Excavation, stockpiling earth, and embankment placement. Control dust by water sprinkling and chemical treatment. Seeding may be effective. Light petroleum or bituminous surface treatment may be used.

3. Blasting, quarry drilling, and rock crushing. Use coverings or enclosures, and restrict operations to low wind conditions.

4. Cement and aggregate handling operations at mixing plants. Enclose operations and restrict to the most suitable location given land use and prevailing wind.

5. Cement or lime in soil stabilization operations. Select equipment to contain dust within dispersing hopper and also to dispense cement or lime with minimum dust.

6. Haul road construction and maintenance. Control dust by water sprinkling and chemical treatment. If heavily used or semi-permanent, paving may be justified. Trucks hauling fill materials should be equipped with covers to prevent the scattering of dust and dirt.

7. Sandblasting and gunite operations. Conduct operations in enclosed space, properly vented, to trap aerosols. Enclosure may be by temporary barriers.

8. Smoke from heaters during winter operations and from asphalt plant heaters. Select better fuels and heaters to ensure higher than 1,400° F temperature and essentially complete oxidation.

9. Paint spraying operations. Control hazards by proper venting of work spaces. Reduce aerosols by use of proper application techniques and properly maintained equipment. Specify alternative coatings or applications.

10. Smoke from burning cleared growth and scrap material. Use pit incineration to limit escape of particulates, especially if burning is permitted for debris disposal.

5. Geology and Topography

Geology and topography are considered here together because of their close interrelationship within the study area. The proposed wastewater management alternatives are not likely to have any significant impacts on geologic resources because the bedrock formations underlying the study area are overlain by thick deposits of recent unconsolidated sediments. Any excavations or alterations of geologic resources will be restricted to surficial deposits of soils.

Topographic alternations are likely to occur at construction sites for wastewater treatment facilities and conveyance lines. Construction of wastewater treatment plants is likely to involve long-term changes of topographic features, but such impacts should be minor because of the relatively flat landscape of the study area and the small amounts of land required. Excavation of conveyance lines would result in minor, short-term impacts on topography because pipeline corridors should be returned to their pre-existing topographic conditions following construction.

As a mitigation measure, topographic alterations should be designed and constructed so that they result in minimal changes to natural drainage conditions. In coastal regions of limited relief, such as southern Escambia and Santa Rosa Counties, minor changes in topography and elevation can cause considerable changes in drainage. Care should be taken to insure that topographic alterations do not result in the drying of existing wetlands or the saturation of presently dry areas.

6. Soils

Minimal impacts to soils are associated with the various wastewater management operations and are primarily related to construction activities. Such impacts may result from soil compaction from heavy equipment, excavations which alter soil profiles, and increased soil erosion. Impacts from compaction and altered profiles are considered insignificant because of the sandy soils prevalent in the study area and the limited amount of soils likely to be affected.

Soil erosion resulting from vegetative clearing and grading operations is a potentially serious impact that is nevertheless considered minimal because of the temporary duration of construction activities. Additionally, a variety of standard mitigation measures for controlling erosion problems are available, as summarized by Leffel (1976):

1. Plan development to fit drainage patterns, topography, and soils of the construction site.
2. Avoid removal of trees and other vegetation whenever possible.
3. Provide temporary cover in critical erosion hazard areas and establish permanent vegetative cover as soon as possible.
4. Minimize exposed land area and duration of exposure.
5. Construct impoundments or temporary holding basins to trap sediment and reduce runoff peaks before flow leaves the construction area.
6. Bare slopes should receive cross-slope scarification prior to mulching and revegetation. Contour plowing and/or terracing may also be effective for some plantings.
7. Slope shaping is an erosion control technique to reduce erosion rates and sediment yields. A concave slope will yield less sediment, because the steepest part of the slope occurs where flow is least. If a concave slope is not practical, a complex slope (convex upper and concave lower) will reduce sediment yield.
8. Permanent mulching, crushed rock, paving, or revegetation can be used to protect raw slopes and other critical erosion areas.
9. Interceptor dikes and diversions using soil ridges or furrows may be constructed to carry runoff around exposed areas and slopes. Consideration should be given to revetting or lining such dikes or ditches (or providing check dams), if the ditches are expected to be permanent.
10. Waterways may be sodded or lined with gravel, stone, concrete, or asphalt.
11. Sediment traps made of hay bales or brush with wire fencing can be placed in drainage channels to form a series of check dams.

12. In some cases, underground conduits are best for carrying trapped runoff from the site.

13. Care should be taken during design and construction to minimize the amount of restoration work required.

Soils may also be adversely impacted by land application techniques using secondary effluent. Secondary effluent contains a relatively high level of suspended solids that can clog soil pores if additional filtration is not provided before application. This impact would be irreversible. However, mitigative measures can be applied, such as reducing application rates or disking the topsoil to allow the soil to treat the effluent adequately. With the use of mitigative measures, such impacts would be minor. Additionally, such potential adverse impacts would be offset by beneficial impacts resulting from increased soil fertility due to the additional moisture and nutrients contained in wastewater effluents.

7. Groundwater

Potential impacts to groundwater resources are primarily associated with alternatives utilizing land application disposal systems. Land application of effluent would add to the groundwater supply, providing a minor beneficial impact. The land parcels through which this water would be applied are not large contiguous parcels, but they are adequate to increase groundwater quantities in their immediate vicinities. In rapid-rate systems, most of the applied effluent would reach the groundwater.

Under most conditions the influences of land application on groundwater resources is minimal if such systems are properly sited, designed, installed, operated and maintained. The extent of impacts to groundwater are related to the quality of effluent before application, soil characteristics and depth to groundwater in addition to the elements listed above. These statements also pertain only to domestic effluent; commercial or industrial effluents must be considered separately based on their wastewater characteristics.

As has been stated previously, both wet soils and highly permeable soils exist in the study area. Each condition , if excessive, can prevent the utilization of land application systems. This is an important consideration in siting a land application system as is the proximity to private or public water wells, other land application systems and surface waters.

For any land application system monitoring wells are an important part of assessing the ongoing and long-term impacts to groundwater. Wells are also essential to mitigating any potential problems.

Impacts on groundwater due to deep-well injection of treated effluent may be more significant; however, extensive research and testing may be required before this alternative can be implemented and fully evaluated. The Monsanto Company and the American Cyanamid Company currently use deep-well injection into a saline aquifer to dispose of wastewater in northern Escambia and Santa Rosa Counties. The long-term impacts of these discharges have not been determined.

Information on the depth to groundwater is limited for the study area. Few wells have been continuously monitored and those that have been monitored do not provide a sufficient network to map depth to groundwater. Assessments can be made only on the Gulf Breeze Peninsula and the barrier islands. The trends indicate:

- Depth to groundwater is less than five feet on the barrier islands (except under dunes)
- Data are not sensitive enough to indicate areas of three feet or one foot to groundwater
- Depth to groundwater approaches ten feet in many places on the Peninsula except around low lying ares (wetlands) and streams.

Unfortunately, this discussion is as detailed as is possible given existing data from the USGS and the Northwest Florida Water Management District. Groundwater's main importance relates to use of the water table aquifer for drinking water and septic tanks. Few private drinking water wells exist in the study area, particularly in the coastal areas and drainfields for septic tanks can be evaluated on a site-by-site basis. If the water table is closer to the surface than permissible for septic tanks, then mounds or other alternative systems could be implemented.

8. Terrestrial Ecosystems

Impacts to terrestrial ecosystems would result primarily from construction activities required under the various wastewater management alternatives. The construction of new wastewater treatment plants, conveyance pipelines and corridors, and land application sites would all result in the loss or alteration of vegetation communities and their associated wildlife.

Although all of the wastewater management alternatives would involve clearing of terrestrial communities, the resulting degree of impact is dependent on the amount of lands affected, the types and maturity of communities, and the duration of effects. Impacts to terrestrial ecosystems were considered minimal if anticipated construction activities were limited to sites which contained largely cleared or altered vegetation communities and did not contain sensitive areas such as wetlands or habitats for protected species. For instance, impacts to terrestrial ecosystems were considered minimal for alternatives proposing new conveyance lines which would be routed through urbanized areas and/or along existing highway corridors.

Such impacts would be temporary in duration and would be effectively mitigated by quickly revegetating construction sites. The following measures are recommended by Leffel (1976) to aid the revegetation of disturbed areas:

1. Spoil areas should be graded. If revegetation must be delayed, areas should be temporarily covered with tarpaulins, burlap, or mulch.

2. Dikes or ditches to control runoff may be required.

3. Several inches of the original or imported topsoil over scalped soil is usually necessary, if seeding is to be effective.

4. Development of adequate soil fertility, which denuded soils often do not have, is essential. Irrigation with treated wastewater often provides sufficient nutrients for good growth of vegetation, and conditioned disinfected sludge is a good soil conditioner.

5. Shallow tillage of areas immediately prior to seeding will break the crust, aid revegetation, and improve infiltration.

6. A seed mixture containing both slow and fast growing varieties proved satisfactory for the site conditions is desirable. Fast growing temporary varieties (such as rye) will protect slower growing permanent varieties (such as bluegrass or fescue).

7. Mulching of seeded or planted areas is most important for speeding revegetation of dredged land.

8. Supplemental controlled irrigation is often required until growth is well underway.

9. Community Services and Facilities

Impacts to most community services and facilities will be minimal with any of the proposed wastewater treatment alternatives. Impacts are associated primarily with construction activities and induced development and are common to all alternatives, varying only in location and extent.

Construction of treatment plants and conveyance lines may necessitate the temporary closing of specific roads and the disruption of traffic flow. This may impede the delivery of certain community services such as police and fire protection and garbage collection. These potential impacts will, however, be temporary and can be readily mitigated by scheduling road closings for off-peak hours and providing alternative access for emergency vehicles.

Increased development supported by federally-funded wastewater treatment facilities will result in increased demand for all community facilities and services. Proper planning and management can eliminate any adverse impacts associated with increasing demand for services, provided the level of service and number of facilities are increased as the service population increases.

Recreation resources and public water supply are two community facility elements that may be more significantly impacted in the study area. These specific elements are discussed in greater detail in later sections.

10. Economic Resources

Economic resources which may be impacted by wastewater treatment decisions include employment, tax base, and revenues. Considering the existing level of sewer service and the extent of the employment base and tax base, impacts on the area's economic resources from any of the wastewater treatment alternatives will be minimal.

Increased employment opportunities will be associated with construction of wastewater treatment and collection facilities. These employment opportunities will be temporary, however, and will be insignificant considering the extent and diversity of the existing employment base.

Property values are often enhanced with the provision of sewers since densities can be increased and potential problems with the operation and maintenance of septic tanks are avoided. In the Pensacola area, however, property values are primarily related to the proximity to the beaches and the market demand for coastal housing. Even where sewers are currently not available, as on Perdido Key, market demand has resulted in high property values and development can be supported by package treatment plants. The demand for housing further inland can be met with low density development served by septic tanks, and the provision of sewers in these areas will not significantly affect property values. The minimal impact on property values will result in minimal impacts to the area's tax base.

Extension of trunk lines, interceptors and collectors will lead to increased sewer revenue through additional user charges. In instances where excess treatment plant capacity is available, as with the Main Street plant, increased revenues may be necessary in order to make the sewerage system financially viable. In the Pensacola area, however, reports indicate that a significant number of homes within the sewer service area are still operating on-site septic tanks or community package plants. Revenues could be increased by requiring these homes to connect to the sewer system through local ordinances, without having to construct extensive interceptors. In addition, the recent formation of the Escambia County Utilities Authority will probably lead to more optimum use of the treatment capacity at the Main Street Plant as currently unsewered areas in the county are connected to the system. Therefore, increased sewer revenues through additional customers will be likely regardless of which alternative is selected, including the No Federal Action Alternative.

11. Historical and Archaeological Resources

Potential impacts to historical and archaeological resources are of minimal concern in the study area. Significant historical resources have been identified in the study area and are primarily outside the area of direct impact for all wastewater management alternatives. The extent of development in the study area makes it likely that major archaeological resources have already been identified or disturbed. Potential disruption of historic and archaeological resources from any new construction can be avoided or reduced by conducting an archaeological survey of the conveyance line corridors and construction sites prior to construction. Identified resources can then be removed from the site or avoided.

12. Public Health

Public health concerns will be of minimal importance in the study area with any of the regional alternatives. All regional alternatives in Escambia County provide for either expansion of the Avondale, Pen Haven and Warrington treatment plants or connection to the Main Street plant. In these instances, it is assumed that areas with failing septic tanks (Bayou Chico and Bayou Grande) will be provided with sewers, thus eliminating a potential source of public health problems.

Regional alternatives in Santa Rosa County do not eliminate all on-site systems; however, no public health problems have been documented in these areas. The City of Gulf Breeze has reported some surfacing of septic tank effluent during wet periods, although associated problems have not been documented.

Public health problems are also not associated with any of the discharge points from the existing or proposed wastewater treatment plants. Effluent from all of the treatment plants (secondary, advanced secondary, and advanced treatment) will be chlorinated before discharge, resulting in the removal of most pathogens. The extent of pathogen removal is directly related to the level of treatment and the operating efficiency of the chlorination process.

The nature of the receiving water bodies also limits the potential for public health problems. Perdido Bay, Pensacola Bay, Santa Rosa Sound and the Gulf of Mexico have sufficient dilution capacity to minimize potential public health problems. In addition, the lack of a viable shellfishing industry in these waters and the complete reliance on groundwater for public water supply eliminate the potential for public health problems due to shellfish or drinking water contamination from surface water discharges.

E. Environmental Impacts Associated with Disposal Alternatives

One of the major issues of this EIS is ultimately how and where to dispose of wastewater. The study area has a large centralized system, in the Main Street treatment plant, to handle the wastewater of most, if not all, of Escambia County. The main limitation is its disposal location within the Pensacola Bay system. The other existing treatment plants dispose their effluent to bayous and other estuarine systems. On the barrier islands, Perdido Key is served by small community/on-site systems whereas Santa Rosa Island is served primarily by a centralized system, disposing to Santa Rosa Sound.

Prime consideration was given to impacts resulting from wastewater management alternatives on sensitive coastal areas and barrier islands. Given the sensitivity and value of these areas, great care must be exercised to institute proper planning and decision-making processes. While federal funding can help solve wastewater management problems, local planning must be coordinated and implemented to result in effective solutions. Otherwise, federal funding could lead to accelerated environmental problems and may be unwise, particularly in light of potential replacement costs of facilities on barrier islands.

Certain attributes and detriments are associated with each of the disposal options in the study area. The following sections discuss the major environmental considerations associated with these options.

1. Estuarine Discharges

Estuarine discharges are those which enter brackish (part salt water, part fresh water) water bodies, including the bayous and bay. Due to the topography of the area, with few rivers and the peninsula and barrier islands, effluent would have to be pumped long distances to either fresh water or the Gulf. Estuaries are critical as hatcheries, nursing grounds, and as a food source for many aquatic organisms, including most commercial species. While they are adapted to undergoing large fluxes in salinity and other components, they remain sensitive to pollutant sources due largely to slow flushing. Due to their sensitive nature and important function, estuarine discharges are probably the most undesirable environmentally.

This poses a dilemma for the Pensacola area since nearly all wastewater is discharged to estuarine systems. One of the alternatives posed by this study would remove all estuarine discharges in Escambia County other than Main Street and Pensacola Beach. This has some attributes, but they need to be weighed relative to the assimilative capacity of the increased load to Pensacola Bay.

Other alternatives involve discharging to land systems or the Gulf, which could relieve some of the loadings to the estuarine systems.

2. Land Disposal

Land disposal systems include spray irrigation, septic tanks and sand mounds, and percolation ponds. Each of these offers potentially positive alternatives to estuarine discharges.

Spray irrigation sites were identified throughout the study area but, due to their location relative to existing facilities, are not feasible in many cases. They are practical only for Navarre Beach and Avondale unless it is desired, or necessary, for environmental purposes to pump effluent several miles. Revenues can be realized from sale of crops which could increase its cost-effectiveness and it is an environmentally preferred alternative.

Septic tanks and sand mounds, if properly constructed, inspected, and monitored, can be an effective wastewater treatment/disposal system for the barrier islands. Many upland areas elsewhere in Santa Rosa and Escambia Counties would also support on-site systems. This could take a large burden off discharging to Pensacola Bay. The key to successful use of on-site systems is their proper construction and service.

Percolation ponds associated with small community package plants can also be a sound option. However, like on-site systems they must be properly constructed and adequately monitored. Elevated nitrogen levels have been observed from the monitoring wells of some percolation ponds. The implications of these levels on water quality or public health have not yet been thoroughly evaluated. At current densities, percolation ponds on the barrier islands have not led to documented water quality or public health problems. In most cases, adequate mitigation techniques are available to solve potential problems.

3. Gulf Disposal

The impacts of a Gulf disposal off the coast of Pensacola is uncertain without detailed information on tide and current patterns, benthic habitats, and substrate. Ocean outfalls have been used for various communities around the United States but outfalls do not exist off the Florida Gulf coast. With tourism and beaches one of the economic mainstays of the region, great care must be taken if an outfall is recommended. However, based on studies conducted in other coastal areas and scientific knowledge of estuarine versus open ocean systems, a Gulf outfall might be preferrable, environmentally, to an estuarine outfall. This statement is based primarily on the slower flushing characteristics in estuaries and the critical nature of estuaries as feeding and nursing grounds for many marine species. Ultimately, however, implementability of the alternative rests on other environmental considerations (e.g., required mitigation of a Gulf outfall), costs, and availability of other acceptable alternatives that are least costly.

F. Environmental Evaluation of Alternatives from Final Screening

Alternative impacts vary, dependent on the magnitude of flows, level of treatment, and type and location of disposal. Removal of discharges from creeks, bayous, rivers and estuaries by conveying effluent to the Main Street plant reduces loads to these systems but increases loads to Pensacola Bay. Analyses are required to determine relative impacts and benefits before alternatives can be selected. The following sections provide a general description of the predominant environmental impacts associated with the final screening of alternatives (see Section II-F).

1. Escambia County

Environmental impacts associated with these alternatives relate primarily to water quality. Aquatic and terrestrial ecology are also issues, as wetlands are common in the Southwest Escambia area. Population and development demands are the primary man-made environmental concerns. While few water quality (Perdido Bay, Bayou Chico and Bayou Marcus) or other environmental problems have been documented, the sensitivity of the area must be recognized by local and state officials and incorporated into planning and design-making processes if the area's resources are to be adequately protected in the future. The extent and type of impacts resulting from the development of this area rest on local and state decision making. See Section II-D for a description of alternatives. All the alternatives include continuing the existing level of treatment at the Main Street Plant with discharge to Pensacola Bay. The plant capacity is projected to remain at 20 mgd (for advanced treatment) although 26 mgd can probably be treated at the advanced secondary level of treatment. Sampling programs have been ongoing for the past few years to determine the appropriate level of treatment necessary to protect the water quality of Pensacola Bay. To date studies have proved inconclusive and additional data are being collected to reconcile this issue.

a. Alternative 1

Adverse impacts could result to the marine environment from the construction and operation of the outfall; however, many of these could be mitigated. Additional surveys would be required to locate the outfall to minimize these impacts. Also, impacts to beaches and areas surrounding the new plant site caused by construction, pipelines and induced development need to be considered.

This alternative would eliminate the discharges from the Avondale and Pen Haven plants which are causing water quality problems in Bayou Marcus Creek and Bayou Chico. However, these areas have already been committed to the

Main Street plant, which would make this alternative difficult to implement. No other significant water quality or public health problems have been documented.

This alternative would provide federal support for developmental projects with growth-induced impacts to water quality, wetlands and barrier islands. Additional pressure to develop these resources would result as well as increased nonpoint source runoff due to higher densities surrounding Back River, Big Lagoon and Perdido Key.

b. Alternative 2

No water quality or public health problems have been documented in the Southwest County, Perdido Key, or Northwest County areas. Likewise no problems are projected if 208 population projections and state permitting procedures are followed that adequately account for pollution sources and protect designated uses. Beneficial water quality impacts would result from removing wastewater discharges from Bayou Marcus and Bayou Chico (Avondale, Warrington and Moreno Courts).

This alternative would promote development with growth-induced impacts to area water quality, wetlands and a sensitive barrier islands environment. Increased water quality impacts would occur from nonpoint sources due to higher density development.

c. Alternative 3

Beneficial water quality impacts would result from removing the Avondale, Warrington and Moreno Courts discharges from Bayou Marcus Creek and Bayou Chico. No other significant water quality or public health problems in this area have been documented or are projected if state permitting procedures are followed. Growth related impacts would not be as significant as with Alternatives 1 and 2.

2. Santa Rosa Island/Gulf Breeze Peninsula

Population densities, development pressure and recreation resources are the man-made environments primarily impacted by these alternatives. With most alternatives resulting in surface water discharges, water quality/ecological issues are also important. While few problems have been documented at current flows, water quality and recreation resources could be significantly impacted by projected increasing loads from discharges into Santa Rosa Sound. This situation should be monitored closely as it develops.

a. Alternative 1

No significant water quality or public health problems are documented for this area. Implementation problems would be associated with obtaining suitable land at Eglin AFB. Local attempts to reach agreement have not been successful.

This alternative would promote a higher rate and density of development. Greater pressure would be exerted to develop wetland, barrier island, floodplain and other sensitive areas. Higher density development would result in greater nonpoint pollutant loadings to area waters, including Escambia Bay, East Bay and Santa Rosa Sound.

b. Alternative 2

This alternative would contribute Santa Rosa County loadings to the Escambia County Main Street plant and use capacity which could otherwise be used for other parts of Escambia County. This situation could present a significant implementation problem.

This alternative could promote a higher rate and density of development. Greater pressure would be exerted to develop wetland, barrier island floodplain and other sensitive areas. Higher density development would result in greater nonpoint pollutant loadings to area waters.

c. Alternative 3

No significant public health or water quality problems have been documented for this area. Implementation of this alternative would support additional development and higher density with associated growth-induced impacts to the sensitive barrier island environment. These impacts, however, would not be as significant as those in Alternatives 1 and 2.

d. Alternative 4

This alternative removes all municipal discharges from Santa Rosa Sound. While that could result in water quality improvements in the Sound, it would also increase loads to Pensacola Bay. No existing adverse impacts to Santa Rosa Sound from these discharges have been documented. Implementation of this alternative would support additional development and higher density with associated growth-induced impacts to the sensitive barrier island environment. These impacts, however, would not be as significant as those in Alternatives 1 and 2.

G. Summary of Environmental Evaluation

The evaluation of environmental impacts and associated considerations (i.e., induced impacts, barrier island policy) for Southwest Escambia County indicates that the local alternative or a hybrid is most acceptable. However, there are constraints to this or any other alternative. If on-site/small community systems are recommended, implementation of policies governing installation, maintenance, and inspection is critical. It is also possible that this alternative would not support the population levels which the local agencies apprarently are encouraging on Perdido Key.

If sewer systems were utilized to convey sewage to the Main Street or southwest plant, impacts from induced development would likely have negative impacts on the environment. To reduce such impacts, conveyance systems could be sized to serve only a predetermined populace that may relate to an accepted carrying capacity. Without local land use planning and more thorough implementation of ordinances or regulations, negative environmental impacts could result from any wastewater management alternative due to inherent problems of unplanned development in sensitive areas.

For the remainder of Escambia County, the most acceptable environmental solution involves removal of effluent from smaller streams and estuaries. This would give impetus to the regional alternatives which centralize wastewater at the Main Street facility. This does not imply an absence of environmental problems resulting from the Main Street plant but considers primarily the assimilative capacities, existing conditions and potential for improvement of the receiving waters in question.

For the Santa Rosa Island/Gulf Breeze Peninsula area, the environmental evaluation shows no significant water quality or public health problems documented in the area. All discharges in the area are meeting their permit limits and are eligible based on EPA and FDER regulations to have their permits renewed. The expenditure of large amounts of funds to construct a larger more regionalized system would promote additional growth with associated adverse impacts to the area's sensitive barrier island, wetland, floodplain and surface water resources.

CHAPTER IV. SELECTION AND DESCRIPTION OF PREFERRED ALTERNATIVES

The conveyance of flows from the Warrington, Avondale and Moreno Courts service areas to the Main Street plant is recommended. The continuation of existing wastewater management practices is recommended for all remaining areas. Alternatives selected to receive federal funds are limited to Escambia County. Funds will be made available to help connect the Avondale and Warrington treatment facilities to the Main Street plant. Both plants have been designated for closure by the Florida Department of Environmental Regulation. Funds will also be available for conveyance of Moreno Courts flows to the Main Street plant. Funds are not being made available for treatment costs but for conveyance alone. Further, funds will be available for interceptors and necessary pump stations based on existing flows.

No Action is the alternative selected for the areas outside the Avondale, Warrington and Moreno Courts service areas; Southwest Escambia, Perdido Key, Santa Rosa Island and the Gulf Breeze Peninsula. This decision is based on two major determinants. First, portions of these areas are sensitive to development due to their proximity to 100-year floodplains, wetlands or estuaries. While wastewater management options in these areas might not promote development in all situations, such options could act to support development and associated populations in sensitive areas. This would be contrary to state and federal policies and regulations that are intended to protect such areas. Second, few water quality, ecological or public health problems have been documented to date. Some areas might be able to receive funding in the future if such problems develop. Proper planning, however, should prevent these problems from developing.

The environmental advantages of the selected alternatives are based on removal of discharges from Bayou Marcus and Bayou Chico, both of which have shown evidence of water quality degradation due to the discharges. The funding decision was based on the water quality data base available and the stance of the Florida Department of Environmental Regulation, indicating that the additional wastewater added to Pensacola Bay from these discharges was preferred to continuing discharges to the bayous.

Impacts to other natural or man-made environments are anticipated to be minimal. Detrimental impacts can be mitigated in most cases. Siting and construction activities associated with conveyance lines can be mitigated, as indicated in Chapter III. Existing rights-of-way can likely be used for most conveyance lines. Some development could be supported by new interceptors, but proper planning can mitigate any potential problems resulting from such development. Current methods of sludge disposal are sufficient throughout the study area and should continue to be adequate.

Protected species and archeological resources surveys will be conducted where necessary to assure these resources are adequately protected. The Perdido Key beach mouse has been proposed for inclusion on the federal endangered species list along with its habitat designation of critical habitat by the Department of Interior. With the importance of the area as an early settlement with various periods of occupation, historical and archeological considerations must be thoroughly examined. Several areas along the barrier islands have been designated as National Seashore and other stretches have been set aside by local governments. Development contiguous to these areas should be undertaken cognizant of the value of these resources.

CHAPTER V. EIS COORDINATION

A. Introduction

This chapter describes the activities undertaken to inform and interact with governmental agencies and public interests potentially affected by this EIS. Coordination activities included:

1. A public scoping meeting
2. Formation of a Review Committee encompassing a broad spectrum of public and private interests
3. A series of Review Committee meetings open to the public
4. Placement of EIS documents in the public library
5. News releases
6. Newsletters
7. Meetings with local officials, interest groups and agency representatives.

Each of these has been an important part of the coordination program to inform interested and responsible parties and to obtain their comments on the progress and findings of the EIS.

B. Coordination with Local, State and Federal Agencies

A required element of the EIS is interaction with agencies that have responsibilities with wastewater management and the associated planning processes. Table V-1 lists the agencies involved with the EIS. Their comments have been incorporated as appropriate into the Draft EIS, and these agencies will be involved through the completion of the Final EIS.

C. Public Participation

The first public participation meetings were public scoping meetings, held on July 15 and 16, 1980, in Gulf Breeze and Pensacola, respectively. The purpose of these meetings was to discuss the EIS process, review 201 activities, and gain an understanding of local issues and concerns. After this meeting, interested persons, agencies, and special-interest groups were identified, and an EIS advisory committee was formed.

The EIS Review Committee is composed of representatives from local governments, public agencies, universities, and private organizations in the study area. Its main purpose is to provide input on local concerns and interests, review EIS outputs, and perform liaison functions between EPA and the community.

Table V-2 lists the organizations and interest groups which comprise the Review Committee. An attempt was made to have a cross-section of economic, business, institutional, public and private interests represented on the

Table V-1. Agencies Involved with the EIS.

Local Agencies

City of Gulf Breeze
City of Pensacola
Escambia County Health Department
Escambia County Utilities Authority
Midway Water System
Pensacola Chamber of Commerce
Santa Rosa Island Authority
West Florida Regional Planning Council

State Agencies

Florida Department of Environmental Regulation
Florida Department of Natural Resources
Florida Department of State (Division of Archives, History and Records Management)
Florida Game and Freshwater Fish Commission

Federal Agencies

U.S. Environmental Protection Agency (Gulf Breeze Research Laboratory)
U.S. Fish and Wildlife Service
U.S. Department of Agriculture (Soil Conservation Service)
U.S. Department of Interior (Gulf Islands National Seashore)

Table V-2. Members of the EIS Review Committee.

Representative	Organization
1. Tom Bell	Home Builders Association of West Florida
2. Bill Blaskis	City of Gulf Breeze
3. Sylvia Bourke	Self
4. Michael Brim	U.S. Fish & Wildlife Service
5. J. D. Brown	Bream Fisherman Association
6. Tillman Burks	Association of General Contractors of America (N.W. Florida Chapter)
7. Edith Carter	League of Women Voters
8. Judy Coe	Sierra Club
9. Alfred Cuzan	Coastal Zone Studies Program, University of West Florida
10. Richard Dunlap	Escambia County Health Department
11. Sue Gentry	Concerned Citizens of West Escambia County
12. W. F. Hampton	Southwest Escambia Improvement Assoc., Inc.
13. Annis Henry	Perdido Key Development Association
14. Jennifer Hodnette	Self
15. Jack Hornbeck	Pensacola Chamber of Commerce
16. L. A. Hunsley	Woodland Bayous Association
17. Robert Montgomery	Pensacola Board of Realtors
18. Norm Morrisette	Florida Department of Environmental Regulation
19. Tom Morton	Santa Rosa County Attorney
20. Richard Radford	Midway Water System
21. Dwaine Raynor	West Florida Regional Planning Council
22. Tom Serviss	County Forester
23. Jim Sheffer	Santa Rosa Island Authority
24. Steve Sheinbaum	Florida Game and Freshwater Fish Commission
25. Buck Thackeray	Gulf Islands National Seashore
26. Muriel Wagner	Save Our Beach
27. Chuck Wigley	Escambia County Utilities Authority

committee. For each committee meeting, the Nominal Group Technique was used to maximize participation from each member of the Review Committee.

The first EIS Review Committee meeting was held on November 20, 1980. This meeting was convened to review the Plan of Study and discuss those areas of concern which should be emphasized in the study. Comments received from the committee were addressed as appropriate by the Final Plan of Study.

The second meeting of the Review Committee was held May 27, 1981. Eighteen of the 27 committee members were present. The major topics of discussion were the Environmental Inventory and Alternative Development Reports. Specifically discussed were county population figures, water quality in Pensacola Bay and wasteload allocations for the water bodies receiving municipal wastewater discharges.

The third meeting of the committee was held December 10, 1981. Sixteen of the committee members were present with ten additional observers. The meeting was held to discuss the Alternatives Evaluation Report and associated issues of concern. The major topics discussed were state and federal environmental policies, general environmental impacts of the various alternatives, population issues, development trends and local controls, costs and implementability of conveyance/treatment, and disposal options.

The fourth Review Committee meeting was held February 15, 1984. Eleven of the 27 members attended. After the 18 month hiatus experienced during the project, the list of committee members was updated. Most members remainded on the committee. The purpose of the meeting was to discuss the alternatives selected to receive EPA funding, the status of the EIS and the schedule for the remainder of the project. Questions from the committee centered on water quality conditions in the area and changes in EPA regulations. The Review Committee expressed agreement with the Alternatives selected to receive EPA funding.

In April 1981, a newsletter was sent to the entire mailing list originally compiled for the EIS. This document summarized activities from the beginning of the study through the process of Alternatives Development. The newsletter was intended to inform all interested individuals and agencies of the progress and direction of the EIS.

CHAPTER VI - LIST OF PREPARERS

Project Personnel

U. S. Environmental Protection Agency

Robert B. Howard	Chief, NEPA Compliance Section
F. Theodore Bisterfeld	EPA Project Officer June 1980 - October 1983
Robert C. Cooper	EPA Project Officer October 1983 - Present
Wayne Garfinkel	EPA Project Engineer June 1980 - October 1983
Leonard Nowak	EPA Project Engineer October 1983 - Present

Claude Terry & Associates, Inc.

Claude E. Terry	President
R. Gregory Bourne	Project Director/Environmental Engineer
Michael Brewer	Environmental Scientist
James C. Hodges	Environmental Scientist
Thomas C. Mather	Environmental Scientist
Louise B. Franklin	Environmental Planner
Craig Wolfgang	Environmental Planner

Gannett Fleming Corddry and Carpenter, Inc.

Thomas M. Rachford	Senior Project Manager
Frank J. Swit	Project Manager
James C. Elliott	Environmental Engineer
Robert J. Fisher	Environmental Engineer
Sara F. Frailey	Environmental Engineer
John W. Jacobs	Soils Scientist

APPENDICES

APPENDIX A

1. Estuarine Water Quality

Pensacola Bay System. Based upon comparison of average 1975 land use related loading calculations with 1978-79 average loading calculated from Permanent Network Station in situ data, total loading estimates into the Pensacola Bay System are quite similar for total nitrogen-N and total phosphorus-P respectively: 1975/1978-79, 19,980/21,362 kilograms per day (44,048/47,095 pounds per day) total nitrogen-N and 2,727/1,973 kilograms per day (6,012/4,349 pounds per day) total phosphorus-P. These loading relationships on a bay by bay basis between 1975/1978-79 are not as close.

BOD_5 loadings, however, appear to have increased significantly since 1975 and/or the land use loading relationships are incorrect. Loading estimates for this parameter in 1975/1978-79 are 38,632/85,246 kilograms per day (85,167/187,932 pounds per day) under average conditions. It may very well be that the 1975 land use loading relationships are low since recent in-stream average BOD_5 values used to calculate loadings are very low, 2 to 5 mg/l (16.7 to 41.7 lb/mgal). It is doubtful that BOD_5 concentrations and riverine flows were significantly lower than recent values.

Escambia Bay. Based upon 1975 land use related loading rates, under average conditions only 15, 19 and 5 percent, respectively of BOD_5, total nitrogen-N and total phosphorus-P loadings can be contributed to point source loadings originating from within the EIS study area. The major source of pollutants comes from point and nonpoint source pollution entering the Bay via the Escambia River. This source of pollutants contributes 83, 80, and 93 percent respectively of the total loading into Escambia Bay from the above mentioned pollutants based on 1975 estimates.

Land use related loading rates (1975) compared to historical loading rates (1960-70) indicate decreased loading into Escambia Bay from Escambia River by 68 and 84 percent, respectively of total nitrogen-N and total phosphorus-P. Recent loading (1978-79) estimates compared to 1975 estimates indicate that only total phosphorus loading from Escambia River may be decreasing while total nitrogen and BOD_5 loading are on the rise. Based upon the accuracy of the calculations and the lack of confidence limits, total nitrogen and total phosphorus loading differences may not be significant; however, the 133 percent increase in BOD_5 can be considered substantial. Insufficient data exists, however, to assess the accuracy of the 1975 land use related calculations.

Blackwater/East Bays. There are no point source discharges into Blackwater/East Bays. Based upon 1975 land use related estimates only 4, 2 and 5 percent respectively of BOD_5, total nitrogen-N and total phosphorus-P entering these bays originate from within their immediate drainage areas under average flow conditions, and all of this is nonpoint source in origin. The remainder comes from point and nonpoint source pollution entering via the Blackwater and Yellow Rivers.

Based on actual stream data, total phosphorus-P loading in 1978-79 is about the same as historical data from the 1960's; it appears that calculated 1975 land use related loadings are high. Total nitrogen-N loading in recent

(1978-79) times are well below historical (1960-70) loadings and 1975 loading estimates. Although no historical records exist for comparison, 1978-79 BOD_5 loadings have more than doubled since 1975. The relevance of this statement depends on the accuracy of the 1975 land use related loadings and, as mentioned, the fact that they actually lie somewhere between background and average as loading estimates.

Santa Rosa Sound/Big Lagoon. Based upon 1975 estimates, 52, 85 and 85 percent, respectively, of BOD_5, total nitrogen-N and total phosphorus-P loading originating from within the immediate drainage areas of Big Lagoon and Santa Rosa Sound, can be attributed to point source pollution. Neither of these bodies of water has a major stream entering them. Contribution of pollutants from the upper bays has not been accounted for.

Perdido Bay. Based upon 1975 estimates, point source pollution within the immediate drainage area of Perdido Bay accounts for 24, 18 and 55 percent respectively, of total BOD_5, total nitrogen-N and total phosphorus-P loading rates into Perdido Bay. These loading estimates have the same limitations as discussed for the Pensacola Bay system. These point sources do not enter the Bay directly but are for the most part attributable to discharges into Eleven Mile and Marcus Creeks. Point and nonpoint source pollution from the Perdido River accounts for 60, 70 and 33 percent, respectively, of BOD_5, total nitrogen-N and total phosphorus-P loadings. Nonpoint source pollution from within the immediate drainage area of the Perdido Bay is of little consequence. While decreasing significantly since the 1960's, recent total phosphorus-P loadings have not decreased significantly since the early 1970's. Total nitrogen loadings appear to have decreased slightly since 1975, while BOD_5 loadings have increased three-fold since 1975: from 5,072 kilograms per day (11,181 pounds per day) of BOD_5 in 1975 to 17,319 kilograms per day (38,182 pounds per day) in 1978-79. It is not possible, based on available data, to assess the quality of 1975 land use-related loading estimates.

2. Near Shore Marine Water Quality

Salinity. The salinity distribution in the surface waters south of the entrance of Pensacola Bay indicates that the surface waters flowing out of the system extend a considerable distance, 11-13 kilometers (7-8 miles), off shore in a fairly well defined tongue. The bottom waters, however, show little such distribution.

Nutrients. Strong negative correlations were noted between inorganic phosphorus-phosphate and distance offshore, indicating the influence of the Escambia Bay System on the near shore surface waters during maximum outflow. In statistical terms, a negative correlation indicates that a relationship exists between two parameters. The negative correlation coefficient between distance offshore and nitrite-nitrogen indicates that the waters flowing out of the Escambia system exert an influence on the distribution of nitrite-nitrogen for the offshore surface waters; however, the major source of nitrite-nitrogen appears to originate from west of the study area. For the most part, the correlation between nitrate-nitrogen in both surface and bottom waters and distance offshore was positive, indicating that the waters originating in the Escambia system had little effect on the Gulf waters at the time of the study.

Silica. Strong negative correlation existed between silica and distance offshore in the surface waters during periods of maximum outflow. The concentrations of silica were generally higher in the surface than in the bottom waters and tended to decrease in concentration as distance increased from the shore. Surface waters entering the region from the northwest and southeast contained high concentrations of silica.

Trace Metals. The correlation coefficient between cadmium and distance offshore was moderate to weak in the surface waters and no consistent relationship with distance and time was found for the bay system. The bay system does not appear to contribute lead to the Gulf since a strong positive correlation was found at maximum tidal outflow between lead in the surface water and distance offshore. There is inflow of lead into the area from the northwest. The correlation coefficients between copper and distance offshore showed poor relationships. The surface waters emerging from Escambia and Perdido Bays, however, contained elevated concentrations of copper. With regard to chromium, the findings were inconclusive. A relationship may exist between chromium and flow from the bay system. At maximum outflow, the surface waters flowing out of the Escambia system were shown to exert an influence on the distribution of zinc in the in-shore system. This did not hold true, however, for bottom waters. There is inflow of zinc into the area from Perdido Bay and the northwest. Strong negative correlations were observed between distance offshore and manganese concentration in the surface waters, indicating an influence by the bay system on near shore waters during the period of maximum outflows. There is also inflow of manganese into the area from the west and northwest and Perdido Bay.

It was concluded in the ESCAROSA I study that little if any sediments in the Escambia Bay and Perdido River Systems are moving out of the bay. Evidence for this was obtained from the lowered trace element content of the sediments near the mouth of the two systems. It appears that the materials settle out in the bay system before reaching the territorial waters.

Pesticides. The data for pesticides were not as complete as those for the trace elements; however, concentrations of pesticides in near shore Gulf waters were found to be significant. The major concern with pesticides is that, while levels detected in the water might be low, phytoplankton and other organisms in the food chain can concentrate pesticides. This can ultimately provide organisms higher in the food chain, including humans, with relatively high pesticide concentrations in their food.

APPENDIX B

Table B-1. Protected Animals Likely to be Found in the Study Area.

Species	Status*			
Common Name	Federal	State	Habitat(s)**	Comments**
AMPHIBIANS				
Hyla andersonii Pine Barrens Treefrog	E	E	Wet pine flatwood; freshwater marsh	Known from Eglin AFB in Okaloosa Co.
Rana areolata Florida Gopher Frog	-	SSC	Sandhill, sand pine scrub	
REPTILES				
Alligator mississippiensis American Alligator	T	SSC	Freshwater marshes, lakes & streams, swamps	
Caretta caretta Loggerhead Sea-turtle	T	T	Estuarine & marine waters	May nest on coastal beaches & dunes
Chelonia mydas Green Sea-turtle	E	E	Estuarine & marine waters	May nest on coastal beaches & dunes
Dermochelys coriacea Leatherback Sea-turtle	E	E	Estuarine & marine waters	May nest on coastal beaches & dunes
Eretmochelys imbricata Hawksbill Sea-turtle	E	E	Estuarine & marine waters	May nest on coastal beaches & dunes
Lepidochelys kempi Ridley Sea-turtle	E	E	Estuarine & marine waters	May nest on coastal beaches & dunes
Gopherus polyphemus Gopher Tortoise	-	SSC	Sandhills, sand pine scrub, coast dunes	Coastal dune populations extinct or nearly so
Drymarchon corais couperi Indigo Snake	T	T	Sandhills, sand pine scrub	Near edge of range
BIRDS				
Ammodramus savannarum floridanus Florida Grasshopper Sparrow	-	E	Grasses & palmettos	Winter visitor in pine flatwoods
Ammospiza maritima Seaside Sparrow	-	SSC	Salt marshes	Resident; breeds
Aramus guarauna Limpkin	-	SSC	Swamps, freshwater marshes	
Campephilus principalis Ivory-billed Woodpecker	E	E	Mature swamps	Probably extinct

Table B-1. Continued

Species Common Name	Status* Federal	Status* State	Habitat(s)**	Comments
Charadrius alexandrinus tenuirostris Cuban Snowy Plover	-	E	Coastal dunes, beaches, tidal flats	Resident; breeds
Cistothorus palustris marianae Marian's Marsh Wren	-	SSC	Freshwater and brackish marshes	Winter visitor
Dichromanassa rufescens Reddish Egret	-	SSC	Salt marshes, estuaries	Visitor
Egretta thula Snowy Egret	-	SSC	Salt marshes, estuarine bays	
Falco peregrinus Peregrine Falcon	E	E	Near rivers and coastal waters	Winter visitor
Falco sparverius paulus Southeastern Kestrel	-	T	Open areas, farmland	Resident; breeds
Florida caerulea Little Blue Heron	-	SSC	Freshwater marshes and ponds	Summer resident; breeds
Grus canadensis pratensis Florida Sandhill Crane	-	T	Freshwater marshes, wet, grassy flatwoods	Winter visitor
Haematopus palliatus American Oystercatcher	-	SSC	Salt marshes, coastal beaches & dunes, estuaries	Visitor
Haliaeetus leucocephalus Bald Eagle	E	T	Near rivers, lakes, marshes & seacoasts	Resident; breeds
Hydranassa tricolor Louisiana Heron	-	SSC	Swamps, fresh & salt marshes, estuaries	Summer resident; breeds
Mycteria americana Wood Stork	-	E	Swamps, marshes	Visitor
Pelecanus occidentalis carolinensis Eastern Brown Pelican	E	T	Coastal beaches, estuaries	Visitor
Picoides borealis Red-cockaded Woodpecker	E	E	Pine flatwoods, sandhills	Mature pine forests only
Sterna albifrons Least Tern	-	T	Coastal beaches & dunes, estuaries	Summer resident; breeds

Table B-1. Continued

Species Common Name	Status* Federal	 State	Habitat(s)**	Comments
Sterna dougallii Roseate Tern	-	T	Coastal beaches & dunes, estuaries	
Vermivora bachmanii Bachman's Warbler	E	E	Swamps, mature hardwood hammocks	Transient
TERRESTRIAL MAMMALS				
Felis concolor coryi Florida Panther, Cougar	E	E	Remote swamps and forests	Probably extirpated in study area region
Peromyscus polionotus trissyllepsis Perdido Bay Beach Mouse	-	T	Coastal dunes	Perdido Key only
Tamias striatus Eastern Chipmunk	-	SSC	Hardwood hammocks	Known only from Okaloosa Co.
Ursus americanus floridanus Florida Black Bear	-	T	Swamps, dense forests	
MARINE MAMMALS				
Balaenoptera physalus Finback Whale	E	E	Marine waters	
Physeter catodon Sperm Whale	E	E	Marine waters	
Trichechus manatus Florida Manatee	E	E	Estuarine and marine waters	
FISH				
Acipenser oxyrhynchus Atlantic Sturgeon	-	SSC	Marine, estuarine and fresh waters	Anadromous
Ammocrypta asprella Crystal Darter	-	T	Fresh waters, sand or gravel bars & pools in large rivers.	Known only from Escambia River
Etneostoma histrio Harlequin Darter	-	SSC	Freshwater, shallow riffles in streams with mod.-swift currents & gravel bottoms	Known only from Escambia River
Etheostoma okaloosae Okaloosa Darter	E	E	Freshwater, small-medium streams, clear water, swift current, sandy bottoms	Known from Eglin AFB in Okaloosa Co.

Table B-1. Continued

Species Common Name	Status* Federal	Status* State	Habitat(s)**	Comments
Fundulus jenkinsi Saltmarsh Topminnow	-	SSC	Salt, brackish or fresh waters in Estuarine marshes	Known from Perdido Pensacola, Escambia, and East bays
Moxostoma carinatum River Redhorse	-	SSC	Large freshwater rivers	Known only from Escambia River

*Status: E = Endangered, T = Threatened, SSC = Species of Special Concern.

**Sources: Pritchard (ed.) 1978. Rare and Endangered Biota of Florida; Bull and Farrand. 1977. The Audubon Society Field Guide to North American Birds; 201 Facilities Plan. 1978.

Table B-2. Protected Plants Known from the Study Area.

Species or Group	Common Name	Status*	Habitats (Comments)**
Aristolochia tomentosa	Dutchman's Pipe	T	Swamp
Calycanthus floridus	Strawberry Bush	T	Hammock
Ceratiola ericoides	Rosemary, Sand Cedar	T	Scrub, Coastal Dune
Cercis canadensis	Redbud	T	Hammock
Chionanthus virginicus	Fringetree	T	Hammock
Cornus florida	Flowering Dogwood	T	Hammock
Epigaea repens	Trailing Arbutus	T	Hammock, Sandhill
FILICINEAE (Class)	Fern Families	T	Hammock, Swamp (All native ferns except Osmunda spp. and Pteridium aquilinium.)
Gordonia lasianthus	Loblolly Bay	T	Swamp
Ilex spp. (Genus)	Hollies	T	Hammock, Swamp, Flatwoods, Coastal Dune (All native species except I. glabra.)
Illicium floridanum	Florida Anise	T	Swamp
Kalmia hirsuta	Wicky	T	Flatwoods, Coastal Dune
K. latifolia	Mountain Laurel	T	Hammock, Swamp
Lillium catesbaei	Pine Lily	T	Wet Flatwoods
Lobelia cardinalis	Cardinal Flower	T	Fresh Marsh, Swamp
Malus angustifolia	Crabapple	T	Hammock
ORCHIDACEAE (Family)	Orchid Family	T	Hammock, Flatwoods, Swamp (All native species.)
Pinckneya pubens	Fevertree	T	Swamp
Rhododendron austrinum	Orange Azalea	E	Swamp
R. viscosum	Swamp Azalea	T	Swamp
ARECACEAE (Family)	Palm Family	T	Hammock (All native species except Serenoa repens)
Sarracenia spp. (Genus)	Pitcherplants	E	Wet Flatwoods (All native species)
Smilax smallii	Jackson Vine	T	Hammock, Swamp
Zephyranthes atamasco	Atamasco Lily	E	Wet Flatwood, Marsh
Zephyranthes spp. (Genus)	Zephyr Lilies	T	Wet Flatwood, Marsh

*Status: T = Threatened, E = Endangered.

**Sources: Ward. 1978. In: Pritchard (ed.) Rare and Endangered Biota of Florida:
201 Facilities Plan. 1978.

APPENDIX C

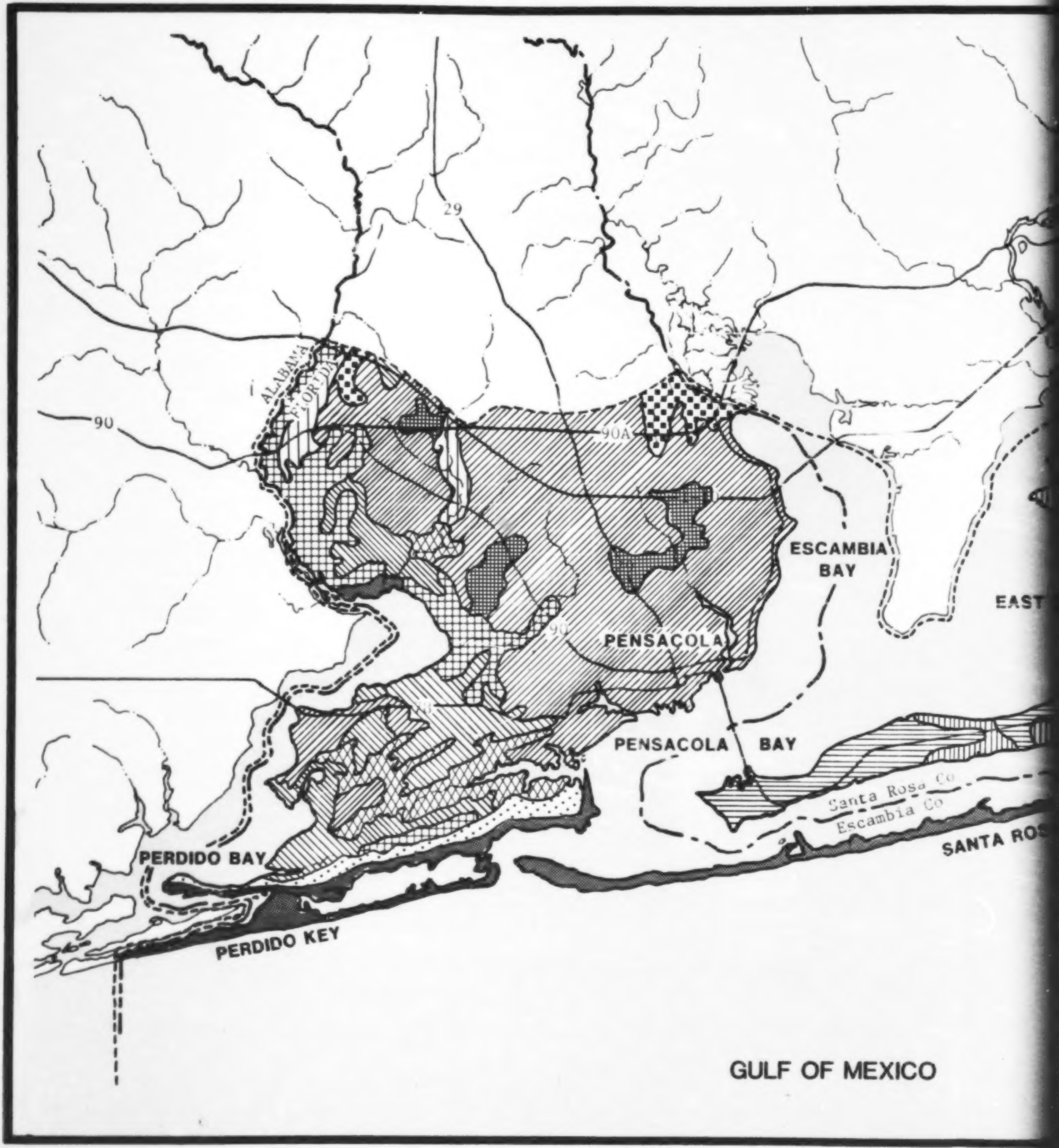
Table C-3. Principal Characteristics of Soils in the Study Area.

Soil Association Series	Natural Drainage	Depth to Groundwater		Permeability in/hr.	
		Meters	**Feet**	**Cm/hr.**	**In/hr.**
Norfolk-Ruston-Savannah					
Norfolk	Good	3.05	10+	1.52-5.08	0.6-2.0
Ruston	Good	3.05	10+	1.52-5.08	0.6-2.0
Savannah	Moderately good	3.05	10+	0.51-1.52	0.2-0.6
Tifton-Carnegie-Faceville					
Tifton	Good	3.05	10+	1.52-5.08	0.6-2.0
Carnegie	Good	3.05	10+	0.51-1.52	0.2-0.6
Faceville	Good	3.05	10+	1.52-5.08	0.6-2.0
Lakeland-Eustis					
Lakeland	Somewhat Excessive	3.05	10+	50.80	20
Eustis	Somewhat Excessive	3.05	10+	15.24-50.80	6.0-20
Klej-Leon					
Klej	Somewhat poor	0.31-0.61	1-2	15.24-50.80	6.0-20.0
Leon	Somewhat poor	0.31-0.61	1-2	50.80	20
Plummer-Rutlege					
Rutlege	Poor	0.0-0.31	0-1	15.24-50.80	6.0-20
Plummer	Poor	0.0-0.31	0-1	5.08-15.24	2.0-6.0
Huckabee-Kalnia-Izagora					
Huckabee	Good	1.82	6+	5.08-15.24	2.0-6.0
Kalnia	Moderately good to good	0.61-0.91	2-3	1.52-5.08	0.6-2.0
Izagora	Moderately good	0.61-0.91	2-3	1.52-5.08	0.6-2.0
Lakewood-Lakeland					
Lakewood	Excessive	3.05	10+	15.24	6.0
Lakeland	Somewhat Excessive	3.05	10+	50.80	20
Lakeland, Ruston, Norfolk, Sunsweet, Carnegie, Cuthbert					
Lakeland	Somewhat Excessive	3.05	10+	50.80	20.0
Ruston	Good	3.05	10+	1.52-5.08	0.6-2.0
Norfolk	Good	3.05	10+	1.52-5.08	0.6-2.0
Sunsweet	Good	3.05	10+	0.51-1.52	0.2-0.6
Carnegie	Good	3.05	10+	0.51-1.52	0.2-0.6
Cuthbert	Good	1.82	6+	0.51-1.52	0.2-0.6
Ortega-Kureb					
Leon	Somewhat Poor	0.31-0.61	1-2	50.80	20.0
Rutlege	Poor	0.0-0.31	0-1	15.24-50.80	6.0-20.0
Pactolus	Somewhat Poor	0.46-0.76	1.5-2.5	15.24-50.80	6.0-20.0
Kureb	Excessively Drained	1.82	6	50.80	20.0
Ortega	Moderately	1.06-1.52	3.5-5.5	1.52-5.08	

Table C-3. Continued

Soil Association Series	Natural Drainage	Depth to Groundwater		Permeability in/hr.	
		Meters	Feet	cm/hr	In/hr.
Pactolus-Rutlege-Mulat					
Albany	Somewhat Poor	0.46-1.06	1.5-3.5	5.08-15.24	2.0-6.0
Garon	Somewhat Poor	0.46-1.06	1.5-3.5	1.52-5.08	0.6-2.0
Johns	Poor to Moderate	0.46-0.91	1.5-3	0.6-2.0	0.6-2.0
Lynchurg	Somewhat Poor	0.30-0.61	1-2	1.52-5.08	0.6-2.0
Leon	Somewhat Poor	0.30-0.61	1-2	50.80	20
Dorovan	Very Poor	0.30-0.76	1-2.5	1.52-5.08	0.6-2.0
Pamlico	Very Poor	0.30-0.61	1-2	1.52-5.08	0.6-2.0
Pactolus	Very Poor	0.46-0.76	1.5-2.5	15.24-50.80	6.0-20.0
Mulat	Very Poor	0.30-0.76	1-2.5	0.51-1.52	0.2-0.6
Rutlege	Very Poor	0.30-0.61	1-2	15.24-50.80	6.0-20.0

Source: Soil Survey Staff. Guide for Interpretation, Engineering Uses of Soils, Soil Conservation Service, USDA.


29
ALABAMA
FLORIDA
90
90A
ESCAMBIA BAY
EAST
90
PENSACOLA
98
PENSACOLA BAY
Santa Rosa Co
Escambia Co
SANTA ROS
PERDIDO BAY
PERDIDO KEY
GULF OF MEXICO

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